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MATHEMATICS IN THE TECHNOLOGICAL SCHOOLS OF COLLEGIATE GRADE IN THE UNITED STATES

INTERNATIONAL COMMISSION ON THE TEACHING
OF MATHEMATICS

THE AMERICAN REPORT

COMMITTEE No. IX

DEPARTMENT OF THE INTERIOR

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THE AMERICAN REPORT.

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MATHEMATICS IN THE TECHNOLOGICAL[1] SCHOOLS OF COLLEGIATE GRADE.

I. INTRODUCTION.—PLACE OF APPLIED SCIENCE IN HIGHER EDUCATION IN THE UNITED STATES.

DEFINITIONS.

The most striking characteristic of technological as of other forms of education in the United States from the international standpoint is doubtless its extreme range of variation and the impossibility of framing general statements and definitions which shall be free from numerous exceptions. For the purposes of the present report a technological school or department may be defined as one giving systematic instruction in engineering and other forms of applied science to students entering the institution at the average age of 18 or 19, usually on the completion of a high-school course four years in length. This definition would exclude, for example, the lower-grade technical schools which admit younger students with less preparation, and which give the training necessary for minor industrial positions, with little or no use of the calculus; it would exclude, again, the evening schools for the supplementary training of men engaged in technical vocations. Neither of these important types is, however, as yet very much developed in the United States in comparison with the technological institutions of collegiate grade which are here discussed. It should be noted, however, that actual technological instruction is often preceded in the higher institutions, either from choice or requirement, by one or more years devoted to academic or general scientific studies; also that a considerable and increasing number of the technological students have previously completed a college course. The technological instruction aims to qualify its graduates both for immediate usefulness in junior positions in the various branches of engineering, in technical chemistry, in architecture, and for ultimate professional responsibility proportionate to individual capacity, etc. The curriculum is usually four years in length (with a present tendency to extension), and students completing it commonly receive the degree bachelor of science (B. S.), with specification of the professional department. If the same institution gives also academic courses leading to the bachelor of arts degree, it is in general deemed, in what follows, to be a college or university having a technological department. The boundary can not, however, be very sharply drawn, and in some of the universities the technological department preponderates numerically.

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[1] There is some diversity of usage in regard to the use of the words "technology" and "technological." These terms, employed in the reports of the Bureau of Education and adopted by the commissioners in their general scheme, correspond with the titles of the various "schools" and "institutes" of technology, and are here used as nearly equivalent in meaning with "applied science" and "engineering," being, however, somewhat more definite and restricted in scope than the first and somewhat more comprehensive than the second. They seem to the writer to have for the present purpose the important advantage of comparative freedom from the vagueness or ambiguity which necessarily attaches to such words as engineering, technical, etc., which are in more general colloquial use. H. W. T.

HISTORICAL SKETCH.

Prior to the Civil War of 1861–1865 technological or engineering education in the United States was represented chiefly by the Rensselaer Polytechnic Institute at Troy, N. Y., founded in 1824; by the work of Union College in civil engineering; by the more recently established scientific schools of Harvard and Yale Universities; and in a special sense by the military and naval academies at West Point and Annapolis. July 2, 1862, a far-reaching act of Congress provided a national grant of public land to each State for the—

> endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts.

Some of these grants proved enormously productive, and subsequent acts have largely increased the resources of the institutions.

The rapid subsequent growth of technological education has been due not only to this legislation, but to the economic conditions of the times. The close of the Civil War was succeeded by a period of extraordinary industrial development, particularly in the building of railroads, but also in manufacturing and mining. The natural resources of the country were so abundant, the demand for immediate results so keen, the supply of trained engineers so scanty, that quick and wasteful methods were inevitable. The existing institutions and the methods of apprenticeship could no longer furnish a sufficient number of engineering recruits. Engineering had to be taught to large bodies of students by men apt to be inexperienced either in engineering or in teaching, sometimes even in both. The constantly expanding subject-matter had to be worked into teachable form by teaching it. Professional employment was so easily obtained that many students were unable to resist the temptation to curtail their preparation for it. Yet, on the other hand, there was widespread distrust of engineering education in its newer forms. Manufacturers accustomed to get on by rule-of-thumb methods were slow to realize the need of employing mechanical engineers and chemists. Educators trained in the classical tradition denied the educational value of utilitarian studies. Thus technological education during the past half century has had to work out its difficult problems sometimes in independent institutions, sometimes in connection with colleges and universities with, for a time at least, a conservative lack of sympathy for applied science. This relationship has greatly influenced the development both of technological education and of the colleges and universities which have undertaken it. At the present time, while its unsolved problems are numerous and pressing, its honorable status is established, and a great host of graduates are eagerly absorbed each year by the industries of the nation.

The fundamental subjects for technological students have naturally been mathematics, physics, and chemistry. Of these physics and chemistry had not been much developed in the older colleges, while a moderate range of mathematics had been widely employed as a means of mental discipline without much emphasis on its applications. The early students of engineering were naturally taught mathematics like their fellow collegians and by teachers of the same type. It was necessary for them, however, to attain some facility of mathematical technique; their time was limited, their appreciation of theoretical discussion not keen. The teachers of engineering, with vague recollections of their own collegiate mathematics (too often studied without reference to its applications), were apt to be successful in avoiding the use of anything beyond trigonometry, and thus confirmed the students in a willing belief in the relative uselessness of analytic geometry and the calculus to practical men. Out of these conditions have grown severe and sometimes exaggerated criticisms of mathematics and mathematicians, coupled with a tendency to insist that mathematics shall be taught merely as a "tool" and that the teaching shall be done by men of engineering training and experience.[1] There are indications of progress toward a better mutual understanding among the parties to this controversy. Recent active discussion will assuredly result in a better understanding and in progressive improvement.

The extraordinary development of applied science, the continual specialization of the engineering professions, the immense advances in the fundamental sciences, physics and chemistry, the necessity for turning out better and more broadly trained men, have in recent years caused severe congestion of the technological curriculum. This has been alleviated in some measure by condensation of subject matter, by time-saving methods of teaching, by utilization of the summer vacation for educational purposes, by concentration of attention on general principles at the expense of technical processes.

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[1] Compare Symposium of Mathematics for Engineering Students, reprinted from Science, of July-September, 1908.

Nevertheless, it has often been found necessary to restrict the time assigned even to mathematics to very narrow limits, and there is a marked tendency among the stronger institutions to make the normal length of the course five years, or even six. The efforts to economize time have led, with other causes, to a critical revision of the traditional mathematical program, of which a fuller statement will be found below. These changes, while supported by a considerable body of expert opinion, are naturally still in the experimental stage. The fact that each higher institution in the United States has the full control of its own curriculum, with no attempt at standardization on the part of Nation or State, is naturally most favorable to the working out of such experiments.[1] Excesses in any direction are, on the other hand, likely to be checked by the inter-relations of the institutions and by the usually conservative influence of the larger and older among them.

PRESENT GENERAL CONDITIONS.

The Report of the United States Commissioner of Education for 1908 shows that of 101,000 collegiate students reported nearly 31,000 were taking engineering courses, 6,000 agriculture, and 12,000 general science. Of 120 universities, colleges, and technological schools included in the report as giving engineering instruction about one-third are wholly technological (or agricultural), and these have about three-eighths of the total number of engineering students.

The United States fosters technological education by considerable annual grants, amounting in 1907–8 to about $2,500,000, not including grants for the Military and Naval Academies. The control and management of the institutions are vested, however, in State (not national) officers, or in corporations which are sometimes wholly private, and sometimes include representatives of the State.

The relation of the several States to higher education varies widely. In the older eastern States instruction of collegiate grade is mainly carried on by great private institutions, some of which have received vast endowments from private sources. In the rest of the country, and particularly in the Middle West, the great State universities are liberally supported from the State treasuries. The national grants have in many cases been assigned by the States to the State universities; in some, however, to separate institutions.

The fundamental difference between the ordinary college (or the academic department) and the technological school or department consists in the definite professional aim of the latter. Here again there is a wide range from the technological school which confines its attention to technical subjects and those on which they directly depend, to the university which insists on two or more years of general college work as a preliminary to the professional. The independent agricultural and mechanical colleges have often maintained somewhat lower standards of admission and graduation.

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[1] In recent years certain private agencies, notably the Carnegie Foundation for the Advancement of Teaching, have come to exert a considerable influence in favor of relatively high standards by establishing conditions of eligibility for institutions deserving financial support.

While most universities and colleges leave their students at present a considerable freedom of choice of subjects, the engineering curriculum is generally laid out with relatively complete definiteness. During the first year or two the curriculum may be identical for all; thereafter the student follows the program he has selected, with perhaps some latitude in respect to the choice among collateral subjects or professional specialties.

The influence of university connection on technological education has various interesting aspects. When academic and technological departments are not very unequal in size and age, and when other conditions are favorable, each may react advantageously on the other. The development of work in applied science has greatly stimulated interest in the sciences themselves and in laboratory methods of instruction. University connection has in many cases insured a larger and stronger staff, a better library, a more favorable position for science departments, and a broader educational spirit and policy. In the larger technological schools many of these advantages have also been realized, together with somewhat greater freedom of development.

On the other hand there is danger that in a university the balance may not always be evenly held between the interests of the academic and the technological students, or there may be an excess of emphasis on abstract science, or the professional spirit of the technological student may suffer impairment from the distractions of academic athletics, etc.

An interesting review of present conditions, and particularly of current criticism of the teaching of mathematics to students of engineering, may be found in the reports of the joint meeting of the sections on mathematics and on mechanical science and engineering of the American Association for the Advancement of Science and the Chicago section of the American Mathematical Society, reprinted from Science of July 17, 24, 31, August 7, 28, and September 4, 1908, and referred to in the following pages as the Chicago symposium. Reference will also be made to a symposium on instruction in calculus at the Madison (1910) meeting of the Society for the Promotion of Engineering Education, of which, however, only a preliminary publication is yet available.

A committee appointed at the Chicago meeting to report to the Society for the Promotion of Engineering Education has courteously placed material collected by it at the disposal of the present committee. The scope of its work is indicated by the following preface of its report (which is to be published in the bulletin of the society):

> The object of this report is to present a synopsis of those fundamental principles and methods of mathematics which, in the opinion of the committee, should constitute the minimum mathematical equipment of the student of engineering.
>
> It is hoped that this report may be serviceable in two ways: First, to the teacher, as an indication of where the emphasis should be laid; and secondly, to the student, as a syllabus of facts and methods which are to be his working tools. It does not include data for which the student would properly refer to an engineer's handbook; it includes rather just those things for which he ought never to be obliged to refer to any book, the things which he should have constantly at his fingers' ends.
>
> The teacher of mathematics should see to it that at least these facts are perfectly familiar to all his students, so that the professor of engineering may presuppose, with confidence, at least this much mathematical knowledge on the part of his students. On the other hand, if the professor of engineering needs to use, at any point, more advanced mathematical methods than those here mentioned, he should be careful to explain them to his class.
>
> The defects in the mathematical training of the student of engineering appear to be largely in knowledge and grasp of fundamental principles, and the constant effort of the teacher should be to ground the student thoroughly in these fundamentals, which are too often lost sight of in a mass of details.
>
> The committee has not found it possible to propose a detailed course of study. The order in which these topics should be taken up must be left largely to the discretion of the individual teacher. The committee is firmly of the opinion, however, that whatever order is adopted, the principal part of the course should be problems worked by the students, and that all these problems should be solved on the basis of a small number of fundamental principles and methods, such as are here suggested.
>
> What is most needed at the present time is a series of synoptical textbooks, which shall present, in compact form, first, the fundamental principles of the science, and second, a classified and graded collection of problems (which would naturally be subject to continual change and expansion). It is the hope of the committee that this report, which is confined to the first part of the desired textbook, will stimulate throughout the country practical contributions toward the second.

II. PLAN OF INVESTIGATION.

A detailed questionnaire (reprinted below), prepared by the present committee in cooperation with that on colleges of liberal arts and universities, State and endowed, was issued by the United States Commissioner of Education in December, 1909, to a large number of institutions believed to be representative. The accompanying reports of subcommittees, one on technological schools, the other on technological departments, are based largely on a comparative study of the replies received. No attempt has been made, however, to secure statistical completeness. The remainder of the present report consists mainly of a review of the subcommittee reports with some comparative discussion of the facts and conditions brought out in them.

The committee tenders its grateful thanks to the Commissioner of Education for his valued aid, and to the fellow mathematicians to whose painstaking and suggestive replies these reports owe much of whatever value they may possess. Special mention should also be made of the cooperation of Professors A. Ziwet, of the University of Michigan and E. R. Hedrick, of the University of Missouri.

Questionnaire on the Teaching of Mathematics in Universities, Colleges, and Technological Schools or Departments.

General Information.

1. Name of institution. Place.

2. Mathematical staff (complete list with present titles, academic degrees, and a brief mention of any special preparation of members, e. g., training in physics, astronomy, or technology, or engineering practice).

ORGANIZATION.

3. List of departments (schools, colleges, etc.) in which mathematics of collegiate grade is taught.

4. List of degrees given in these departments for undergraduate work.

5. In these different schools or departments are there separate mathematical departments? If not, what combinations are made? What relations subsist between different mathematical departments? (Compare with question 2.)

6. Status of mathematical department in its relations—dependence or independence—to the general faculty or to other coordinate departments.

7. Status of mathematical teachers as to internal organization of mathematical department; influence or control exercised by senior teachers or head of department over junior colleagues.

8. To what extent are members of the department restricted or directed by administrative officers in the conduct of their instruction, either as to subject matter or methods?

9. What principles govern distribution of teaching? For example: Do senior teachers give a large or small proportion of elementary or required instruction, and are advanced elective subjects intrusted to junior teachers?

10. Are department meetings held regularly for discussion of current teaching, or scientific matters, or both?

11. To what extent are collegiate and technological students taught in the same classes, and what are the reasons for or against such combinations? (Compare 26.)

12. To what extent are mechanics and descriptive geometry or other branches of applied mathematics taught by the mathematical department?

13. By what system or method are vacancies in the mathematical staff filled?

14. What material changes, if any, in matters referred to in questions 1 to 13 have been made during the past 10 years?

15. What tendencies to change are now in operation, and what changes seem to you desirable?

CURRICULUM.

16. Extent of admission requirement. (Preferably in terms of the definitions recommended by committee of American Mathematical Society and now in use by the College Entrance Examination Board. In case of deviation from these, a brief statement of reasons is desired.) Samples of examination papers or certificate blanks are requested. Age of students at entrance?

17. General quality of mathematical preparation as indicated by the results of your admission system? A brief discussion of prevalent defects in preparation is invited.

18. What changes of admission requirements in mathematics have been made during the past 10 years, and what changes are still desirable?

19. Outline of mathematics curriculum, with brief statement of conditions which have determined it, and of any existing tendencies to change it. It is desired that time and number of exercises allotted to each subject be shown, that textbooks in use be mentioned, and any deviation from usual selection or order of topics be stated, with reasons. The extent to which subjects ordinarily separate are combined is of particular interest. Status of mathematics, as required or elective subject, as a major or minor subject, as requirement for degrees, or for recommendation for secondary teaching.

20. What mathematical courses are required or elective in advance of the (first) course in calculus? Does an extension of this list either as to required or elective subjects seem to you desirable and probable for technological students? Do you favor, for example, mathematical requirements equal to those of the continental technological institutions?

21. To what extent is the curriculum determined either as to content or aim by the needs of other departments dependent on mathematical preparation?

22. To what extent is there a tendency in emphasizing applications of the mathematics to introduce elementary mechanics, physics, thermodynamics, etc., in the courses in mathematics?

23. How far and in what manner are mathematics and engineering, or allied subjects, correlated?

24. What is the attitude of professional and applied science departments toward pure mathematics as to time allotment, aims of instruction, etc.? Do those departments prefer to teach such mathematics as they desire?

25. To what extent is the mathematical curriculum restricted by congestion of subject matter in the engineering courses?

26. To what extent does the mathematical curriculum for technological students correspond with that for collegiate students? (Compare 11.)

27. What instruction is given in history of mathematics?

28. What changes have taken place in the matters covered by questions 19 to 27 during the past 10 years, and what changes are present tendencies likely to cause? In particular, any present or projected extension of the usual four-year technological course affecting the mathematical instruction should be stated.

AIMS AND METHODS OF TEACHING—EXAMINATIONS.

Brief description of aims and methods of teaching, indicating relative emphasis, and in particular—

29. Aims in teaching as to relative emphasis on different results—e. g., mathematical dexterity, analytical power, logical keenness, accuracy in computation. To what extent are our students—collegiate or technological—gaining from their mathematics either general culture or mathematical power and resourcefulness?

30. Extent to which lectures, oral recitations, blackboard work, written tests, criticism of student's work in class or privately, are used. Are so-called seminar methods found useful in teaching undergraduates? If so, in what subjects?

31. Are definite programs of elementary courses prepared in advance; and, if so, are they duplicated for teachers and students?

32. Manner in which records are made up, and extent to which they depend on term work or a final examination.

33. Degree of importance attached to independence in ordinary problem work, and steps taken to secure or test it. Is problem work criticized and returned? If so, by whom?

34. Extent to which personal conference of students with teachers is employed.

35. Normal amount of teaching for teachers of different grades, and extent of their incidental duties.

36. Average size of classes in principal subjects. If instruction is coeducational, state proportion of women students.

37. Use made of models. Are models made by students?

38. Is mathematical drawing or other work of laboratory character required or offered by the mathematical department?

39. To what extent are students allowed, or advised, to use tables of formulas in examinations or in the classroom?

40. What changes in methods of teaching have been made during the past 10 years, and what are present tendencies?

Preparation of Teachers.

41. What kind and extent of preparation seems to you most desirable for members of your staff? For example: An academic or a technological undergraduate course (or both) followed by graduate work in mathematics? Do you consider it practicable and desirable to secure teachers who either before or after their graduate work in mathematics have had actual engineering experience? What importance do you attach to previous teaching experience in college teaching? In secondary teaching? (See also question 13.)

42. Do you favor a systematic attempt on the part of technological schools or departments to prepare students for mathematical teaching? Should technological students of exceptional mathematical ability be induced to specialize mainly in mathematics?

43. Is it your opinion that colleges or technological schools should provide for undergraduate courses in the pedagogy of mathematics?

44. State, if possible, the total number of different persons who have given instruction in your mathematical department, or departments, during the decade 1899–1909.

45. Do you favor permanent or protracted retention of teachers in rank below that of assistant professor?

III. REVIEW OF REPORTS OF SUBCOMMITTEES ON INDEPENDENT TECHNOLOGICAL SCHOOLS AND ON TECHNOLOGICAL DEPARTMENTS OF COLLEGES AND UNIVERSITIES.

This review is based in part on the actual subcommittee reports, in part on other sources. While the subcommittee reports are intended to be primarily descriptive accounts of existing conditions and tendencies, with incidental expressions of opinion, the present review undertakes to deal with the subject in a somewhat broader general manner in the light of whatever information and experience are at the disposal of the committee, but always with reference to current conditions.

ORGANIZATION AND STATUS OF MATHEMATICAL STAFF.

The size, personnel, and proportion of men in different grades are in each institution a matter of more or less complex evolution, affected by many personal considerations. The mere size of the mathematical staff depends for its significance mainly on the relation it bears to the number of students, a relation not easily determined in the case of the institutions having a single mathematical staff for academic and technological students. In the judgment of the committee a department should normally have not less than half its members of professorial grade, including assistant professors. Comment on the qualifications desirable in junior teachers will be made later.

The departmental organization and the relation of the mathematical to the other departments appear to be relatively simple and elastic, as is naturally desirable. The extent of departmental organization existing or needful naturally varies widely with the size of the department and with the range of experience and attainments among its members. It appears to be generally recognized, as it should be, that men worthy of appointment even as junior teachers are entitled to a high degree of freedom as to methods of teaching. On the other hand when large classes are distributed in small sections among a number of teachers there should be control or approximate agreement as to subject-matter, aims, and rate of progress.

The very limited extent to which theoretical mechanics and descriptive geometry are taught in the mathematical departments seems to the committee unfortunate, and will be discussed in connection with the mathematical curriculum below.

ENTRANCE REQUIREMENTS IN MATHEMATICS.

The usual entrance requirements in mathematics for technological schools and departments include elementary algebra and plane and solid geometry. A considerable number of institutions require also plane trigonometry, a few add advanced algebra, and a few arithmetic. The following definitions of the more usual subjects, prepared by a committee of the American Mathematical Society in 1903, have been adopted by numerous institutions and by the College Entrance Examination Board.

ELEMENTARY ALGEBRA.

The four fundamental operations for rational algebraic expressions; factoring, determination of highest common factor and lowest common multiple by factoring; fractions, including complex fractions, ratio and proportion; linear equations, both numerical and literal, containing one or more unknown quantities; problems depending on linear equations; radicals, including the extraction of the square root of polynomials and of numbers; exponents, including the fractional and negative; quadratic equations, both numerical and literal; simple cases of equations with one or more unknown quantities, that can be solved by the methods of linear or quadratic equations; problems depending upon quadratic equations; the binomial theorem for positive integral exponents; the formulas for the *n*th term and the sum of the terms of arithmetic and geometric progressions, with applications.

It is assumed that pupils will be required throughout the course to solve numerous problems which involve putting questions into equations. Some of these problems should be chosen from mensuration, from physics, and from commercial life. The use of graphical methods and illustrations, particularly in connection with the solution of equations, is also expected.

PLANE GEOMETRY.

The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurement of the circle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of lines and plane surfaces.

SOLID GEOMETRY.

The usual theorems and constructions of good textbooks, including the relations of planes and lines in space; the properties and measurement of prisms, pyramids, cylinders, and cones; the sphere and the spherical triangle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of surfaces and solids.

These definitions, eliminating minor variations in the existing definitions of different colleges, were framed with a view to simplifying the elementary algebra by omitting certain non-essentials, and at the same time enriching it by the introduction of graphical methods and of more numerous problems. At present an attempt is in progress to define geometry less vaguely by means of a standard syllabus.

The current unit-scale of the Carnegie Foundation and the College Entrance Examination Board rate these subjects as follows:

Algebra 1½, plane geometry 1, solid geometry ½, trigonometry ½, a unit being supposed to represent a year's work in the school with four or five exercises per week. The total admission requirements of a college or technological school of normally high standards amount to 14 or more such units.

The few institutions requiring advanced algebra differ very widely in their definitions of it, and it appears to be the general opinion that this subject is within the proper range only of the exceptionally able student in an exceptionally strong preparatory school. As to plane trigonometry as an entrance requirement there is some difference of opinion. It is generally recognized that the concrete trigonometry with its solution of practical problems is quite within the grasp of preparatory students and of decided interest to them in its application of the combined resources of geometry, arithmetic, and algebra. The same can hardly be said, however, of those theoretical portions of the subject so important for later mathematical work. It is also important to bear in mind that in the average secondary school sufficient emphasis will rarely be laid on accuracy in computation for the needs of the future student of engineering. Some institutions prefer that all the time available for mathematics in the high school should be devoted to the maximum degree of thoroughness in the elementary algebra and geometry rather than to a program including trigonometry also. Wherever elementary trigonometry can be completed without sacrifice of such thoroughness, it is probably desirable that it should be included. It does not appear that any increase in mathematical entrance requirements beyond elementary algebra, plane and solid geometry, and plane trigonometry, as above defined, is either probable or desirable.

As to a specific requirement in arithmetic, the vital importance of accurate computation and the marked inability of entering students in this direction are generally recognized. Only a few institutions, however, seek a direct remedy for this inability by an entrance requirement in arithmetic; some expect the examination in trigonometry to be a more or less adequate test; some include numerical computation in the algebra and geometry papers. The efficacy of any of these methods is limited.

As to defective quality of preparation, the causes are probably far too deep-seated to admit of anything more than gradual amelioration. The demand for preparation in mathematics is so large that the elementary teaching must be often entrusted to persons not specially qualified for successful mathematical teaching either by natural endowment, interest, or training. The financial rewards of the teachers are usually small. On the other hand there has been a marked improvement in textbooks, in the establishment of periodicals for secondary teachers, and particularly in the organization of local associations of teachers of mathematics—including both school and college teachers—for the discussion of professional topics.

As to the school programs, it is obviously important that the study of mathematics should not have been discontinued during the final year of preparation. A candidate who was adequately prepared a year or more before entrance may have lost much during the interval, and such losses are probably more serious in mathematics than in most other entrance subjects on which the dependence of later work is less direct.

MATHEMATICAL CURRICULUM.

In all the institutions mathematical instruction is continued from the lower limit determined by the respective entrance requirements, with more or less review overlapping, through at least a first course in the calculus, thus including additional algebra, trigonometry (if not passed at entrance), plane analytic geometry, as well as the elements of the calculus. In the stronger institutions the elements of solid analytic geometry are usually added, and the above program is completed by the end of the second year, the calculus extending through the whole of this year; in them an elementary course in differential equations is also generally required, at least of students in mechanical or electrical engineering. Among subjects less frequently required spherical trigonometry and least squares may be mentioned. A considerable number of institutions, mostly universities, offer a wide range of advanced electives including, for example, projective geometry, Fourier's series, vector analysis, theory of elasticity, hydrodynamics, theory of functions, etc. Few undergraduate engineering students find time, however, in a four-year course for such electives.

An interesting analysis of the mathematical curriculum in 17 representative institutions may be found in Prof. E. J. Townsend's valuable contribution to the Chicago symposium. It is there shown that "the average number of recitations given to each subject for the 17 institutions is approximately as follows: College algebra 50, plane trigonometry 46, analytic geometry 80, and calculus 130," this last usually including also a short course in differential equations. The range of variation is notably wide, in algebra from 15 to 90 exercises, in plane trigonometry from 29 to 70, in analytic geometry from 55 to 110, in calculus from 70 to 180. In interpreting these figures it must, however, be borne in mind that the institutions differ not only in their entrance requirements but in the strictness with which these are enforced, that the boundaries of the various subjects are not invariable, and that a relatively small time allotment may be compensated by a large requirement of outside preparation, or by more efficient methods of teaching, as subdivision of classes into smaller sections, or otherwise. The length of recitations is also not uniform and it may well be doubted whether 6 recitations per week for 15 weeks can be considered exactly equivalent to 3 per week for 30 weeks, or 2 per week for 45 weeks. Only one of the 17 institutions specifies a separate course in scientific computation, and this as an elective.

There is no apparent tendency to extend the program of required mathematics for engineering students beyond elementary differential equations. The extension of the engineering course to five years would probably favor such changes as the introduction of more thorough and extended courses in calculus, in mechanics, etc., and on the other hand the encouragement of elective mathematics.

The total time assigned to mathematics naturally varies with the general condition of the curriculum as to congestion or the reverse, and with the attitude of the administration and faculty as to where the boundary shall be drawn between mathematics and applied science. The congestion referred to, together with the development of mathematical criticism, and other causes have tended to compel more or less revision of textbooks in which the following tendencies may be noted:

In college algebra, the omission or postponement of such topics as series, partial fractions, undetermined coefficients, and the close articulation of the subject with analytic geometry and calculus, by insistence on the use of graphs, and by the early introduction of the ideas of function and derivative;

In analytic geometry, a similar tendency to employ calculus methods and to broaden the range of curves studied;

In calculus, a much earlier introduction of the fundamental ideas of function and derivative, as already noted, diminished emphasis on such matters as indeterminate forms, the avoidance of defective proofs, and the use of a much wider range of applications, including such matters as velocity, acceleration, attraction, moment of inertia, etc., a process naturally continued in differential equations.

Two current tendencies already noted have particular interest:

1. A better correlation between mathematics and engineering branches by the introduction of numerous and varied applied problems, or in some cases by insistence upon a thorough course in mathematical mechanics, and

2. A unification of the mathematical curriculum involving the redistribution of the whole subject matter according to its difficulty or its needfulness as an auxiliary, with little or no reference to the traditional division of subject matter into algebra, analytic geometry, and calculus.

The former change in its limited form has become rather general. The latter is still in the experimental stage.

CORRELATION OF MATHEMATICS WITH TECHNOLOGICAL SUBJECTS.

The introduction of applied problems connects itself with a gradual change of attitude on the part of the mathematical teachers, with the increasing development of applied mathematics both inside and outside the technological institutions, and with the criticism by physicists and engineers of the older, more abstract mathematical teaching, as illustrated by the following quotations from a distinguished engineer in the Chicago symposium:

> Abstract mathematical studies, if pursued as a kind of intellectual calisthenics, may produce a pure mathematician, but they may unfit a man for practical engineering.
>
> Mathematics is used in engineering to express the quantitative relations of natural phenomena. The mathematician delights in the relations; he divorces them from the phenomena and gives them abstract expression, while the engineer is concerned with the natural phenomena; he demands the physical conception; the medium of expressing these relations is of secondary consequence.

Such passages might be multiplied indefinitely from recent discussion, oftentimes coupled unfortunately with remarkable exaggerations and not less remarkable remedial suggestions.

For the 1910 meeting of the Society for the Promotion of Engineering Education the following questions were issued by the president in advance:

> 1. What proportion of the students in engineering schools, who have completed the required work in calculus, are able to apply that knowledge and solve simple practical problems?
>
> 2. What proportion of the graduates of engineering schools, who receive instructions in calculus and in its applications to mechanics, thermodynamics, and engineering, are capable of using calculus as a tool, readily, with difficulty, or not at all? etc., etc.

The answers to these questions by members of the society are obviously rough estimates—the questions themselves not admitting of exact answers—and vary far too widely to have definite quantitative significance. They leave no doubt, however, as to the existence of a serious need. Even if, as is claimed by some of the mathematicians, the difficulty is largely due to the inherent conditions of student human nature, and to the disposition of some of the engineering teachers to expect the impossible, it is only the more important that mathematicians should cooperate in maintaining the best relation between their subject and those which follow it.

Mathematical teachers and textbooks have both made progress in this direction. The tendency of the best modern texts, particularly in the calculus, is to emphasize the power to analyze and state problems mathematically and to interpret the solutions. This tendency has naturally had its enthusiastic votaries who have gone to the extreme of concreteness, including problems not merely of mechanics but of technical engineering. The serious objections to this are that under ordinary time limitations such matter can only be taught at the cost of needful thoroughness in mathematical technique, and that the successful dealing with these problems presupposes wider acquaintance with engineering data than the students concerned can generally have. Whatever may be appropriate for the exceptional student of previous technical experience, the average graduate needs a solid foundation in mathematics as such, and in mechanics, before attempting to deal with engineering problems. When he has laid that foundation it is better economy of time for him to be turned over to the engineering specialist, who should in turn have a sufficient mathematical training to utilize all the mathematical power his students bring to him. If not thus utilized it speedily atrophies.

Something has been accomplished already, and more will probably be accomplished in this direction by including a larger number and a wider range of applied problems in the mathematical courses. It seems to the present committee, however, of great importance that the general course in calculus should be followed by a thorough course in mechanics presented from the mathematical standpoint. Mechanics is commonly taught to some extent as a branch of general physics, to some extent also under the title applied mechanics or otherwise by one or more of the engineering departments. The vital importance and fundamental position of the subject are certainly such as to make it wise to present it from all three sides, the mathematical, the physical, and the engineering, at whatever expenditure of time this may require. On the mathematical side the need may be met either by having a substantial course in theoretical mechanics given by the mathematical department, or by the existence of an independent department of mechanics with sufficiently mathematical tendencies. The choice between these alternatives may naturally depend more or less on personal and local consideration. Without such emphasis on the mathematical side of mechanics the continuance of a gap between mathematics and engineering may be regarded as inevitable.

The argument for a more mathematical treatment of descriptive geometry is similar in kind, but the difficulty and the need appear to be less serious in degree. It is not of course the opinion of the committee that either mechanics or descriptive geometry should be taught wholly in the mathematical department, but rather that each should be strengthened on the mathematical side.

The so-called "Perry movement" in England and certain phases of current mathematical reform movements in Germany and France have aspects in common with this increasing attention to applications of mathematics, but this is eminently a matter in which local considerations must have great weight. American conditions are so different from English, German, and French as to preclude exact comparison, much more the adoption of foreign models or methods. A swinging pendulum passes from one extreme to the opposite, and the best current opinion in this country is not in sympathy with changes so radical as some which have been advocated in England. It is cogently urged that while mathematicians must teach their subject to the engineering students always with due appreciation of the uses to be made of it, with due subordination to abstract theory, with due care to facilitate the transition from mathematics through mechanics to engineering, they should on the other hand never be led away from this fundamental and difficult task in an ineffective effort to teach a little engineering prematurely by employing illustrative problems which are not yet wholly intelligible on the technical side. Thirty years ago current mathematical texts in the calculus contained none but geometrical applications. Now such physical subjects as velocity, work, and attraction are not only introduced as applications, but they are introduced at a very early stage for the still more important purpose of making the fundamental conceptions of derivative and integral more completely intelligible and significant. This wider sweep of applications undoubtedly sacrifices something of the previous unity and formal simplicity of the subject. The gain in interest and significance to the student far more than offsets this.

An exceedingly important form of correlation, apparently overlooked or underestimated by some of the engineering critics of current mathematical teaching, is that it is at least as much their own duty as that of the mathematicians to teach the use of mathematics as a tool, or let us say, rather, as an instrument or method. The teacher of mathematics usually needs all the time he has to teach his own subject and to meet the engineering teacher halfway by teaching general nontechnical applications. It is the part of the teacher of engineering to familiarize himself with the mathematical subjects, the methods, and even the notation his students have learned. Then he can teach them how to use their mathematics with a success and completeness not possible to his mathematical colleague. It is as ineffective and uneconomical to require a mathematician to teach engineering as to require an engineer to teach mathematics. Each must aim at the best attainable correlation with the other.

UNIFICATION OF THE MATHEMATICAL CURRICULUM.

The recasting of the series of elementary subjects into a consecutive course in mathematics presents many interesting aspects. In a striking passage of his Elementarmathematik vom höheren Standpunkte aus. I, 1908, Prof. Felix Klein draws an interesting contrast between two systems of mathematical thought and development. In the first—

> a particularistic conception of mathematical science is fundamental, dividing the whole into a series of well-defined provinces. In each of these one seeks to gain his ends with the minimum use of outside means or dependence on allied branches. The ideal is a structure of each division beautifully crystallized out and logically complete in itself.

The other system, on the contrary—

> lays the chief emphasis on an organic interrelation of the separate branches, and on the numerous suggestions they afford each other. It prefers, accordingly, the methods which open up the simultaneous understanding of several branches from a unifying standpoint. Its ideal is the comprehension of all mathematical science as of one entity.

Recognizing the great part which each system has played in the development of mathematics he earnestly deprecates the predominance of the former in the mathematics of the schools, under the influence of Greek geometry and of the great eighteenth century analysts, who developed algebraic theories of infinite series and the like, with careful avoidance of the newer calculus methods.

The recent experiments in unifying the mathematical curriculum of the technological course represent a reaction against this prevalence of the first system distinguished by Klein. In discussing them it may be noted first that a similar tendency has some time since led to the introduction of the elements of analytic geometry in the form of graphs into the preparatory instruction in elementary algebra, and that there is a tendency in recent textbooks of elementary geometry to depart more widely from strict Euclidean traditions. The revision of the more advanced program has sometimes taken the partial form of merely eliminating college algebra or analytic geometry as a distinct subject. In one recent case the process has been carried further by combining the algebra, analytic geometry, a first course in calculus, and elementary differential equations into a single course and textbook.

Among the characteristics of this revision are:

The earlier introduction and consequently more prolonged study of the calculus ideas and methods, function, derivative, etc.;

The treatment of analytic geometry rather as a general mathematical method than as a separate subject, with less emphasis on the conic sections and more on the geometric interpretation of a great variety of equations, including parametric forms;

The consecutive discussion of functions of one variable by the methods of algebra, analytic geometry, and calculus;

The subsequent combination of solid analytic geometry and partial differentiation in a briefer discussion of functions of two variables.

The working out of such a program is necessarily attended with some sacrifice of formal simplicity, and with occasional apparent loss of continuity. The advocates of it believe that such a thorough revision has, by testing values and eliminating non-essentials, effected considerable economies in time, and that the advantages of the plan will decidedly outweigh these defects, particularly as more prolonged experience facilitates the actual teaching. The student should for example gain power of discriminating attack by the use for each problem of the method best adapted to its solution. Such a program may prove less easy both to teacher and student, but may at the same time be none the less worth while. The chief difficulties to be guarded against are apparent or excessive discontinuity of subject matter, and the corresponding dispersion of interest and attention on the part of the student. He finds it difficult to grasp the unity of mathematical analysis and easy to lose the thread in passing from the methods of algebra to those of calculus and then of trigonometry. It must be borne in mind, however, that this sort of transition is just what must be easily made in any successful application of mathematics, and that the relative ease of completing a somewhat arbitrarily defined subject and then passing to the next may be too dearly purchased. The result of the experiments in this direction will certainly prove of much interest.

In comparison with the current reform movement in Germany, which also aims at increased and early emphasis on the ideas of function and derivative, the American institutions have a certain compensating advantage for the more limited mathematical preparation of their entering students, in the fact that the higher institution here is able to determine the form and content of mathematical work farther back than would be the case abroad, from about the point indeed at which such changes would naturally take effect.

AIMS AND METHODS OF TEACHING—EXAMINATIONS.

Methods naturally depend upon aims, and a discussion of aims is essentially a discussion of the relation of mathematics as a part to technological education as a whole. The first essential aim of technological education is professional efficiency, which must naturally depend in some measure on command of mathematics as a tool. A less superficial analysis must recognize the distinction between immediate usefulness and ultimate efficiency, between training for subordinate positions and education for posts of large professional responsibility and leadership. A broader view must reckon with the fact that the student is to become an educated man and a citizen, not merely an engineer, and that his success even as an engineer will be incomplete if his education has been too narrow.

It is such considerations as these, recognized as they are both by the stronger institutions and by the leaders of the engineering professions, that must be reckoned with in any attempt to determine or to state the aims of mathematical teachings. In the limited time ordinarily available some degree of skill in mathematical technique, in computation, in the solution of equations, in differentiation and integration, some degree of power in applying mathematics to concrete problems must be given to all who are to complete technological courses. To the more capable student at least the teaching and study of mathematics should not, and does not, confine itself to these objects. To them there will come some recognition of the vitality of the science and of the inevitableness of its fundamental notions, as expressions of any exact thinking about phenomena, some due appreciation of the combined elegance and power of its methods, some ability to think mathematically. Such results can of course be accomplished only by teachers who are really mathematicians, and who therefore, unlike certain critics, see in their science something more than an elaborate computing machine or slide-rule. It is on teaching inspired by such aims that technological education must depend in part for that breadth and culture value which it ought always to have. The historical point of view should naturally find due recognition in this connection.

The methods employed in mathematical instruction tend in general to hold the student responsible for continuous study of a textbook and for the solution of many problems, with relatively little dependence on final examinations. Lectures are employed but sparingly, larger classes are divided into numerous sections, the average size in the stronger institutions not exceeding 15 to 20. The amount of classroom work per teacher in these institutions is ordinarily 12 to 15 hours per week, but in others may reach 20. With four or five small sections the teacher is expected to acquire personal knowledge of the individual student and his needs, and special provision for private couference is not infrequent. So-called "mathematical laboratory" work, the drawing of careful plots, and the making of models are precluded in general by lack of time, but the student's work in the laboratories of physics, mechanics, and engineering serves a similar purpose.

As to the use of tables of mathematical formulas for integration and other purposes, usage varies widely. Mathematical teachers are generally averse to encouraging the relatively mechanical use of such aids. It seems fair to suppose, however, that before the completion of the mathematical course students may advantageously be instructed in the use of such mathematical tables as will be of most future service to them, without which, indeed, their mathematics may remain largely unused.

PREPARATION AND QUALIFICATIONS OF TEACHERS.

The ideal teacher of mathematics for technological students, besides the qualifications desirable in teachers generally, needs on the one hand to be a mathematician by natural endowment and by training, on the other hand to have intelligent appreciation of the mathematical needs of future engineers, and sympathetic interest in their point of view. This naturally presupposes previous occupation with and some measure of attainment in applied mathematics. Capacity for mathematical investigation, while naturally desirable, is not indispensable, but some form of scientific productivity may well be insisted upon. The particular method by which the individual teacher has acquired the qualifications stated is of minor importance in comparison with the personal considerations involved. Under present educational and industrial conditions the supply of competent teachers will doubtless long continue to fall short of the demand; only a small minority of technological students will engage in teaching, and the number of men of engineering experience possibly available for mathematical teaching may be safely characterized as "an infinitesimal of higher order." In the judgment of the present committee the future teacher of mathematics to technological students should have taken an undergraduate course, either technological or including a substantial amount of physical science with laboratory work. Such a course should be strong in pure and applied mathematics, and should be followed by graduate study, also including both pure and applied mathematics, and leading in general to the doctor's degree. This plan is believed to be as simple and economical as possible, but by no means the only one for reaching the normal professional standard. The graduate work will in general be taken at a university, and it is important that the candidate should be enabled under the rules of the university to avail himself of opportunities for advanced work in mechanics, mathematical physics, or engineering with full credit toward his degree.

The importance of previous experience varies widely with individuals, and only the stronger institutions will be able to insist upon it for minor appointments. Experience in secondary teaching, if not too prolonged, may have particular value from its frequently greater systematization, and still more in giving the future college teacher intimate knowledge of the conditions and methods obtaining in the schools from which his students are to come.

IV. CONCLUSION.

The history of mathematics exhibits many alternations of interest between pure and applied mathematics. The needs of astronomers or physicists have stimulated the development of a certain branch of mathematics, the development has been continued by mathematicians with more or less indifference as to the applications until the vein has perhaps been worked out. At present in the United States the pendulum seems to be swinging toward increasing interest in applied mathematics, at any rate up to differential equations, with probability of resulting advantage both to mathematics itself and to the allied sciences. Toward this change the technological institutions and the development of technology have contributed much by presenting problems requiring the development of new mathematical methods, by creating a need for the thorough mathematical teaching of great numbers of students, and by promoting through their reaction on the universities and on the public a widespread interest in the applied sciences.

Not many technological institutions or departments have yet encouraged research in applied mathematics, or undertaken to train future teachers of mathematics. Not many technological students have capacity for mathematical research or inclination for mathematical teaching. It is fair to expect that as the stronger schools gain in resources, and as the excessive demand for their graduates slackens with the increasing supply, they will build up graduate departments in which advanced work in mathematics will be an important element. At the same time the graduate schools of the universities with more liberal recognition of applied science will attract a larger proportion of technological graduates.

There is evidence that the technological schools and departments are reacting from over-emphasis on purely professional training and efficiency in favor of the fundamentals of general scientific education. The leading universities already require two years of academic instruction preceding the technological. While it seems improbable that the completion of an academic course will become a prerequisite for admission to the technological, a considerable and probably increasing number of students are likely to follow this plan.

On the whole the situation of mathematics and mathematical teaching in the technological institutions, if not altogether satisfactory, may be regarded as at least relatively so, in the sense that needs are recognized and conditions are favorable for steady progress. There is a just basis for high expectations as to the future development of the science which has owed so much of its past and present vitality to the insistent demands of astronomers, physicists, and engineers. In meeting these expectations measurably, in building a solid foundation for their engineering students, and at the same time in doing their part in that development of the science, it may well be the unceasing endeavor of mathematicians in the technological institutions to use their limited time economically and efficiently, studying the needs of the applied science departments sympathetically, enlisting all possible reciprocal interest, maintaining the dignity and integrity of mathematical science, not insisting too much on its rigorous refinements.

SUBCOMMITTEE 1. INDEPENDENT TECHNOLOGICAL SCHOOLS.

The following report consists essentially of an analytical study of replies received from 22 institutions, wholly or mainly technological in their character, to the questionnaire issued on behalf of the commission by the United States Bureau of Education. The text of this questionnaire and a discussion of the general subject may be found in the above report of the main committee. Certain statements of fact, applicable alike to the independent schools and to the university departments, have also been relegated to the main report.

I. ORGANIZATION.

Questions 2–15: Mathematical staff, degrees, experience, etc.; divisions of institution and relations to each other; relation of individual teachers to department and to administrative officers; distribution of work; method of appointment; tendencies to change.

Mathematical staff.—An examination of the mathematical faculties in the different institutions shows that a large proportion of all the professors, associate professors, and assistant professors hold one or more degrees above the baccalaureate degree. Among the instructors about half appear to hold such advanced degrees. Nearly half of the full professors and about a quarter of the assistant professors and instructors hold the degree of doctor of philosophy. Less than one-half of the full professors are graduates of classical colleges; something less than half seem to be graduates of technological schools or of the scientific departments of universities, while it is impossible to tell from the other degrees, Ph. D., etc., whether those who hold them were originally graduates of colleges or of technological schools. The degrees would indicate that the associate professors are for the most part graduates of technological schools or the scientific departments of colleges. Among the assistant professors there seem to be more college than technological graduates, although, as in the case of the full professors, the degree of doctor of philosophy does not indicate the course pursued. The majority of the instructors are from technological schools, although quite a large number are from colleges. There are also a few who have the degree of doctor of philosophy, but this does not indicate the kind of institution from which they first graduated.

Among the full professors a very large majority, if not all, have done advanced, or specialized, work; probably more than half of them in mathematics and more than half of them in engineering or related subjects. The others have specialized in physics and chemistry. A large proportion of the assistant professors also have had university training, and most of these have specialized either in mathematics or advanced engineering work. The graduate work of instructors is stated in so few instances that it is impossible to make any general statement or draw any conclusions.

It is evident from the above statement that the technological schools expect professors and assistant professors to have done graduate work, usually in the line of mathematics, but the work in engineering is esteemed so desirable that a man who has specialized in that rather than in mathematics may be appointed to a mathematical assistant or full professorship. It is also evident that the institutions expect the men who hold full or assistant professorships to have carried their advanced work to such a point that they have received an advanced degree.

The first degree granted by the technological schools is usually bachelor of science (B. S.), with or without added specification of department. Several, however, give the professional degree civil engineer (C. E.), etc.

The mathematical department is wholly independent of other departments, but generally under the control of the whole faculty so far as the amount of time to be devoted to mathematics is concerned and sometimes as to the individual subjects taught.

The department as a rule has a head who exercises general control over the other instructors, but these instructors appear to be practically independent in the conduct of their classroom work.

The members of the department are not restricted by the administrative officers either in the subject matter or in their methods, except in case of two institutions where the subject matter is laid out and general methods suggested in a conference between the head of the department and the president.

In the majority of institutions the advanced subjects are taught by the older professors, but in three institutions the professors and assistant professors meet all classes; in two institutions work is assigned without reference to rank, but according to fitness; and in one institution advanced elective subjects, like differential equations, least squares, etc., are taught in the engineering departments.

In the majority of technological schools meetings of members of the department are held irregularly for the discussion of topics connected with current teaching work and in a few of the institutions regular meetings for the same purpose are held. These meetings are generally for no other purpose, but in the case of a few institutions general mathematical subjects are discussed. The tendency to hold such meetings is naturally stronger in the larger institutions where 10 or more men have charge of different sections of a class. In two institutions there are daily meetings for the teachers of the different sections of the same class.

In the majority of the technological schools the mathematical department teaches mathematics only. In a very few cases mechanics is taught, and in two instances descriptive geometry.

Vacancies are usually filled by the board of trustees upon the recommendation of the president. This is virtually an appointment by the president. In nearly all cases the head of the department is consulted by the president, and usually the head of the department nominates to the president either directly or through the dean.

In most of the institutions considered there have been no recent changes of organization, and no changes are deemed desirable. A few institutions express the wish that the different branches of mathematics might be better correlated, and some desire a closer correlation between the mathematical department and the engineering departments.

II. MATHEMATICAL CURRICULUM.

Questions 16–28: Entrance requirements; outline of curriculum; elective subjects; mathematical needs and attitude of other departments; correlation with allied subjects; time restrictions; tendencies to change.

Entrance requirements.—Nearly all the institutions admit students on the basis of high-school certificates. Nearly all require elementary algebra, plane and solid geometry for admission, the definition of these subjects corresponding with those recommended by a committee of the American Mathematical Society in 1903. (See page 14.)

In a few cases other mathematical work, usually plane trigonometry, may be offered.

Where a definite minimum age limit is given it is usually 16 or 17 years, but so far as the answers indicate the actual age of entrance is from 18 to 19, as for other collegiate courses.

As a rule the technological schools report that students are not well prepared in algebra and geometry. The students are said to be inaccurate, to be unable to reason, to have forgotten elementary principles. Several institutions call attention to the fact that algebra being given in the first two years of the high-school work, much is forgotten before the end of the course. One institution states that it must receive graduates of the high schools because it is a State institution. Some feel obliged to review high-school algebra in order to prepare the student for college algebra.

Few changes of entrance requirements have been made during the past 10 years, except that several institutions which did not formerly require solid geometry now do so. Several institutions suggest that trigonometry might be added to the requirements, but some of them say that it is so poorly taught in the high schools that its addition is questionable.

Curriculum.—College algebra, trigonometry, analytic geometry, and calculus are usually required of all engineering students. In a few cases the subjects taught under algebra are given in connection with analytic geometry and calculus. There seems to be quite a tendency to take up analytic geometry and calculus together, and in some places to begin their study early in the course. A few institutions offer elective mathematical subjects. In some cases special subjects are required in some courses; thus, differential equations may be required of electrical or mechanical engineers.

The textbooks used are the ordinary modern mathematical textbooks. In a few cases mechanics is taught in the mathematical department. In two institutions the mathematical work is very heavy, in one of these 7 or 8 hours being required per week during the greater part of the freshman and sophomore years; and in the other, from 9 to 15 hours per week during the first two years. In some instances the elements of spherical trigonometry are given to all students, while in others this work is reserved for the civil engineers.

Few institutions require mathematical work beyond calculus, but quite a number offer electives. Where more advanced work is required it is usually differential equations or mechanics. Most of the institutions do not desire to increase their requirements in this respect.

Nearly all the institutions agree that the course in mathematics has been determined very largely by the needs of the engineering departments. While the statement is not definitely made, it appears in many cases that the course of study has been laid out by the mathematical professors so as to give students as much mathematical training and power as possible, at the same time having in mind that these men are to become engineers and will need to apply their mathematics to engineering work.

There is a tendency to emphasize the applications of mathematics by introducing problems in mechanics, physics, etc. The extent to which this can be done depends upon how much physics, mechanics, etc., the student knows. None of the institutions represented claim to teach physics or mechanics in the mathematical department; a few of the departments distinctly say that they do not give these applications, as it is their business to teach mathematics.

It is difficult to tell from the answers just how much correlation there is between the department of mathematics and the various engineering departments. The impression gained from reading the answers is that there is not very much correlation, certainly not so much as would seem desirable. Simple engineering problems are sometimes given in connection with mathematical work, but at the time the work is given students often do not understand the fundamental principles of the engineering subjects.

The professional departments seem not to interfere with the time allotment for mathematics, nor in general with the aim of instruction, although they sometimes desire to have more applications included in the mathematical courses. There are one or two exceptions to this, where it is alleged that the professional departments expect the mathematical department to teach the principles of engineering and to make applications. The engineering departments do not wish to teach mathematics.

About half of the institutions report that there is restriction of time on account of the congestion in the engineering courses; that the time for mathematics has been reduced to a minimum; and that the mathematical departments can not teach the subjects as they would wish to.

In most institutions no formal instruction in the history of mathematics is given, but many historical points are discussed informally in the classroom.

There is nothing to indicate that many changes have taken place during the past 10 years, or that many changes are contemplated. There is no indication that any extension of the four-year courses will affect mathematical instruction.

III. AIMS AND METHODS OF TEACHING—EXAMINATIONS.

Questions 29–40—Aims: Dexterity, power, keenness, accuracy, resourcefulness. Methods: Lectures, recitations, blackboard, tests, criticism, records, independence of work, conferences, amount of work for teachers, size of classes, uses of tables, tendencies to change.

Aims.—It seems probable that in defining these aims the professors of mathematics have stated the results which they would like to accomplish rather than those which they are actually obtaining. Some say that they do not strive for mathematical dexterity at all; others state that dexterity and accuracy receive the most attention.

Several give their aims in teaching as follows: Analytical power, logical keenness, accuracy, mathematical dexterity. Several state that considerable culture and resourcefulness are obtained. The question has not been answered fully enough for satisfactory conclusions.

Methods.—It is evident that few lectures are given to undergraduates in the technical schools. Large classes are divided into small sections receiving independent instruction, but following a common program and taking the same final examination. Oral recitations are held almost every day, with a large amount of blackboard work. Written tests are frequent in all of the institutions. Student work is criticised in class freely, and in almost all of the institutions students have the opportunity to confer with the instructors.

Programs of elementary courses are prepared in advance in some of the larger institutions, but not to any extent in the smaller ones. These programs are intended for the use of the instructors, but are changed to suit conditions.

Records; examinations.—Final grades are usually based on term work and final examination, although in a very few institutions final examinations are not given. In some institutions the grade is made up of results of written tests, daily recitations, and final examinations. The weight given to each of these parts varies from tests four-fifths, final examination one-fifth, to daily work one-half, final examination one-half. Several institutions do not allow the final examination to count for more than one-third of the final grade.

Problem work.—About half the institutions seem to lay great stress upon independent problem work, and have problems corrected by student assistants or by instructors and returned to students. The answers from the other half would indicate that problems are not systematically criticized and that no special effort is made to secure independent work.

Conferences.—In the majority of institutions the mathematical professors have regular office hours, and students are encouraged or required to have conferences with the instructors. This is especially true with respect to poor students. In only a few institutions is it stated that there are no such conferences.

Amount of teaching.—About half the institutions require from 12 to 16 hours per week of teaching, the others from 18 to 20 hours. It is evident that professors and assistants professors often have considerable committee and other additional work. Instructors do not seem to have any committee work, but they are expected to give considerable time to correction of papers, etc.

Size of classes.—In only three institutions is the average size of sections above 25, while in quite a number of them it averages from 15 to 20. The majority of them do not have women students, and where there are women the number seems to be very small.

Models; drawing.—In the majority of cases models are used to illustrate problems in solid analytics and calculus, but in a few cases it is distinctly stated that no models are used. In very few instances are the models made by the students.

Mathematical drawing and other laboratory work are not required or offered by mathematical departments with the exception of one institution.

Tables.—About half the institutions allow their students to use tables of integrals, while a smaller number allow tables of logarithms, and some others. A few do not allow tables at all.

Changes.—In the majority of institutions there have been no radical changes during the past 10 years.

IV. PREPARATION OF TEACHERS.

Questions 41–45: There seems to be considerable difference of opinion as to whether an academic or a technological course forms the better preparation for an instructor of mathematics in a technological school. A number of institutions suggest that both should be required. Practically all, however, agree that graduate work in mathematics is necessary. Nearly all believe that engineering experience is very desirable, but that it is almost impossible to obtain. There seems to be a great difference of opinion also as to whether previous teaching experience is desirable, some of the answers indicating that it is, and others stating very positively that it is not especially desirable for a young instructor who can obtain his teaching experience in the technological school. Nearly all agree that experience in a secondary school is not desirable.

The majority of the answers would indicate that a systematic attempt should be made on the part of technological schools to prepare students for mathematical teaching, although quite a large number have expressed a contrary opinion. Several of the answers call attention to the fact that the salaries offered mathematical teachers in technological schools are so low that few students care to consider such positions. About half of the answers favor inducing technological students of exceptional mathematical ability to specialize in mathematics; but some of the answers are decidedly against this. This may be interpreted to mean that the professors in the technological schools believe that students of exceptional mathematical ability have great opportunities as engineers and should not be induced to specialize in mathematics, thus giving up engineering careers.

It is the general opinion that technological schools should not provide for undergraduate courses in the pedagogy of mathematics.

Tenure.—In the majority of institutions the total number of different instructors during the past 10 years has been about twice as great as the number of instructors now in the department. This shows of course that the younger instructors change after a few years of service, presumably for the sake of increased incomes.

There is no unanimity of opinion in regard to the protracted retention of teachers without promotion. About half the answers indicate a belief that instructors should be retained permanently or for indefinite periods, while the other half indicate the contrary. The reasons are not given. There is probably a feeling that a man ought not to be held as an instructor after a certain period of years, because the salaries are usually very low, and he ought to find some work where he would be better paid. Some of those who do not favor keeping an instructor for a protracted period imply that they think if an instructor is worth keeping he should be given an assistant professorship.

The Agricultural and Mechanical Colleges.

These institutions were for the most part founded under the act of Congress of 1862, to which reference has previously been made. They include some of the separate technological schools on the one hand, and some of the State institutions on the other. It is convenient to group by themselves, however, those which concern themselves exclusively with agriculture and mechanic arts, and in which agriculture is a relatively important element. The classification is, however, not at all precise. The following notes based on replies from eight institutions may serve as a comparison of these institutions with the foregoing.

The majority of the heads of the mathematical departments have had scientific or technological training, and a majority of the associate professors seem to be graduates of scientific or engineering institutions; none of the latter are doctors of philosophy, and one has no degree. Of the instructors, a majority have had technological training; none hold the doctor's degree. In several instances members of the faculty give instruction in more than one department.

In one institution mathematics and engineering make one department.

In most of these institutions the requirements for admission are considerably lower than those of the technological schools, but there is a tendency upward. When an age limit is mentioned it is usually 16.

The mathematical curriculum usually includes some elementary algebra and solid geometry, followed by the subjects usually given in the other institutions. In most of them nothing is required or offered beyond the first course in the calculus. The agricultural and textile courses include less mathematics than the engineering.

The assignments of teaching average relatively high, amounting in some cases to 20 or 25 hours per week. The same is true of the size of sections, which is usually 20 or 30.

SUBCOMMITTEE 2. TECHNOLOGICAL DEPARTMENTS OF COLLEGES AND UNIVERSITIES.

INTRODUCTION.

The following report is based primarily on the returns to the questionnaire prepared by the committee and sent out on its behalf by the United States Commissioner of Education, as stated in detail in the general report of the committee. These returns have been supplemented somewhat from other sources where such material seemed essential to illustrate the practical aspect of the question. In order to give full weight to the returns, this material is introduced in the form of a supplement to the main body of the report.

ORGANIZATION OF DEPARTMENTS.

The replies to the questionnaire indicate a marked uniformity in the mathematical departments represented with respect to organization as well as method and aim of instruction. The cause of this uniformity seems to be that technological departments of colleges and universities are very largely a direct outgrowth of the academic departments by which they were preceded. This is evidenced by the fact that in none of the institutions represented is there a separate department of mathematics for technology, the mathematical instruction for all courses being centralized in a single department and given by the same corps of instructors. It is also noteworthy that the mathematical department is, in general, independent of other departments, and not subjected to definite restrictions as regards subject matter or methods other than a general limitation as to the time allowance for the work.

In the smaller colleges no distinction is made between students of technology and others so far as mathematical instruction is concerned. In the larger institutions the engineering students are usually separated from the academic, chiefly for administrative reasons and not because of any essential difference in the method or content of instruction. The size of the sections into which large classes are subdivided is usually limited to 25 members, this number seeming to be considered the maximum which can be taught to advantage at one time by the ordinary blackboard and recitation method.

In the smaller institutions it is not considered necessary to hold regular meetings of the department. In the larger universities, however, such meetings are held with more or less regularity for the purpose of encouraging an esprit de corps among the teaching staff, and enabling the professor in charge to keep in touch with the work of individual instructors and the department in general.

From an examination of the degrees held by the members of the various mathematical faculties represented, several interesting facts are apparent. It is found that an engineering degree is exceptional, the degrees most commonly held indicating that the majority of instructors have had an academic training. There is also manifest an increasing tendency to employ only those who have shown special ability by taking a higher degree, preferably the Ph. D., implying specialization in pure mathematics. This fact is especially noteworthy in its bearing on the relations between the departments of mathematics and technology, considered later.

ENTRANCE REQUIREMENTS.

The returns show that it is the general custom to admit students to all departments of the college or university on presentation of a satisfactory high-school certificate. The mathematical preparation thus certified invariably consists of arithmetic, elementary algebra, and plane geometry, usually with the addition of solid geometry and sometimes plane trigonometry, as fully explained in the general report of this committee. Throughout the Middle West it is customary for the university to publish regularly an accredited list of high schools whose students are thus admitted on certificate without examination. The principals of the schools on this list are kept informed as to the requirements of the university and the progress of their graduates after entering, by a high-school visitor specially appointed by the university for this purpose. From the university standpoint this system is very effective, as it enables the university to secure a much more thorough and uniform grade of preparation than would otherwise be possible. From the high-school standpoint the system was formerly criticized as unwarranted dictation on the part of the university, by reason of the fact that only a small proportion of high-school students are preparing for university work. This objection is now obviated in all the larger high schools by offering a variety of courses, only one of which is college preparatory.

In some cases, especially where the system of accredited schools is not in vogue, the universities report that the high-school preparation in mathematics is deficient for university purposes. This deficiency is usually credited to the fact that high-school mathematics is ordinarily given in the first two years of the course, and that in the two years which intervene before entering the university much of the work is forgotten or obscured. Under the system of accredited schools, however, it is customary to specially strengthen the college preparatory course in this respect by thoroughly reviewing during the last year all the mathematics previously learned.

In this connection it is of interest to contrast the American system of teaching elementary mathematics for a short period and then dropping it completely with the continental method as exemplified by the French lycée and the German and Austrian Gymnasium, Real-Gymnasium, and Ober-Realschule, where the study of elementary mathematics is carried on continuously for eight or nine years.

MATHEMATICAL CURRICULUM.

The extent of the mathematical curriculum is largely a question of breadth and thoroughness of training, the subject matter being nominally the same in all the institutions represented. The customary program of instruction includes algebra, trigonometry, and analytic geometry for four or five periods per week during the freshman year, and the elements of differential and integral calculus for the same number of periods during the sophomore year. During these two years much of the student's work is academic, whereas at the end of this period it becomes almost wholly technical. Mathematics is thus classed as an academic subject, at least so far as instruction is concerned, although mathematical principles are of course universally recognized as the basis of technology. As a matter of fact, only a small proportion of the mathematics actually taught is ordinarily used in engineering practice or in the succeeding courses in technology. As evidence of this fact the following statement may perhaps be as conclusive as any single fact that could be mentioned.

In returning a purely technical article that had been submitted to him for publication, the editor of one of the largest and most influential engineering journals in this country wrote as follows:

> While we find this an admirable treatise on the subject, we regret that it is too highly mathematical for our columns, due to the fact that it presupposes a thorough understanding of the principles of the calculus. It is our experience that the average machine designer has no, or at least only a vague, idea of the use of calculus.

This statement should perhaps be regarded as a criticism of the engineering profession in this country rather than as evidence that mathematical instruction is inefficient, or that a satisfactory technical education can be built up on such a limited mathematical basis as here implied.

This condition of affairs is no doubt as true for civil as for mechanical engineers. In electrical engineering, however, a somewhat higher degree of mathematical attainment is demanded, which is usually recognized by including differential equations as a required subject in this course.

The fact that ordinarily more mathematics is taught than actually used is sufficient reason why the returns to the questionnaire indicate no tendency to extend the mathematical requirements or to encourage electives in this subject.

CORRELATION OF DEPARTMENTS.

In the majority of institutions the needs of technological departments are at least nominally considered in arranging the work of the department of mathematics. Further than this there is no correlation of departments in any of the institutions represented in the returns. In a few of the smaller institutions the departments of mathematics and engineering are administered by the same head for economic reasons. In one instance it is specifically stated that not only is there no attempt at correlation, but that mathematics is taught as a separate discipline without reference to its technical applications.

UNIFICATION OF THE CURRICULUM.

Within the mathematical departments themselves there seems to be a general tendency toward rearranging the subject matter into a more compact and unified course. Effort is directed toward obliterating the formal boundaries which have been raised between the various subjects in the course of their historical development, and to construct a single course in mathematics in place of a succession of separate and somewhat unrelated courses in algebra, trigonometry, analytic geometry, and calculus. The most notable instance of this experiment is that being carried out at the Massachusetts Institute of Technology.

CORRELATION OF MATHEMATICS AND TECHNOLOGY.

The consensus of opinion on this topic is that in mathematical courses mathematics should be taught rather than applied science. It is generally believed that the introduction of technical applications in the mathematical classroom is advisable only when they are so elementary and familiar as not to destroy the integrity of the mathematical courses or diminish their educational value by obscuring general principles. All agree that no illustration should be used which requires a technical knowledge not possessed by the student or readily explainable to him, as the introduction of unfamiliar concepts merely offers the student two difficulties to surmount instead of one. The chief difficulty seems to be in finding technical illustrations which are sufficiently familiar, as the mathematical courses are confined to the first two years of the curriculum, and thus precede the student's professional training.

In one instance the objection is raised that by enlarging applications the concrete tends to fill so large a place in the mind that the principle in hand is obscured as one of general application. The general opinion, however, is that if it is possible to arrange courses in parallel, so as to furnish material for illustration, a training in formal mathematics in connection with its technical applications gives depth of understanding, strength of grasp, and freedom of use most conducive to the production of efficient and progressive students.

ATTITUDE OF DEPARTMENTS OF TECHNOLOGY.

The majority of replies state that technological departments are satisfied to leave the mathematical preparation of their students to the department of pure mathematics as at present constituted. In a few instances it may be inferred from the returns, however, that technological departments are not wholly satisfied with the present preparation in mathematics as a basis for their work and would prefer to have the subject taught by men more familiar with its technical applications. In connection with this, there is a tendency to diminish the amount of pure mathematics required of technological students, one reply going so far as to say that the subject (as now taught) is regarded by engineers as a necessary evil.

There is a substantial agreement that there is no reason why engineers should be given essentially different elementary training in mathematics from others, but that all mathematical training is simply a question of teaching the subject thoroughly and in such a way that the student shall be able to use it freely. From the standpoint of mathematicians separate departments of mathematics for different classes of students are regarded as narrowing and hurtful to all concerned, and regret is expressed that specialized professional courses are occupying an increasingly large place in the curriculum to the exclusion of a more thorough grounding in broad fundamentals

METHODS OF INSTRUCTION.

The method of instruction ordinarily pursued is based on the use of a textbook. Instruction then proceeds by assigning definite portions of the text, with daily recitations on the portion assigned, usually in the form of solving the accompanying problems in the text. The chief differences in applying this method consist in the manner of securing the required amount of problem work, some instructors relying chiefly on blackboard work during the class period, while others require independent outside work. The textbook method has the advantage of being simple and easy to follow, and from the point of view of the instructor doubtless produces more uniform results than could be obtained otherwise. It is open to criticism, however, as being conventional and stereotyped, and from the student's subsequent record in technology it develops that he is usually tied to the range of problems, and even the notation, given in the text studied, and is deficient in the freedom of use which comes from an actual mastery of fundamental principles.

Models are seldom used in the classroom and a mathematical laboratory is practically unknown.

AIM AND RESULTS OF INSTRUCTION.

The returns indicate that in deference to the opinions of departments of technology an effort is made to differentiate between mathematical instruction given to engineers and to others. For engineers the aim is to prepare for their professional courses by insisting on accuracy in computation and emphasizing such principles as are of immediate and practical application. At the same time it is the general opinion that there is a broad cultural value in mathematical training which engineers almost wholly miss by reason of the limitations to which their work in mathematics is subject. The cultural value of mathematics is defined in this connection as consisting in the concentration of attention on definite concepts and their inferences.

There are exceptions to this view, however, the replies having the greatest weight of experience back of them asserting that when mathematics is properly taught, although limited to technical subjects, engineers profit largely by this training aside from the specific value of the subject as a professional tool. This opinion, expressed by several, is summarized in one reply as follows:

> Our successful students are gaining clearness and accuracy of thought, power of attack, and fertility of invention that place them far above men not thus trained. Almost invariably those students who have risen most rapidly to high positions of power and usefulness have been among the most brilliant mathematicians so far as they have chosen to cultivate mathematical subjects.

PREPARATION OF TEACHERS.

The consensus of opinion on this point is that it is desirable that teachers of mathematics in technological schools shall have had some technical training or experience, or at least be interested in the technical and practical applications of mathematics. It is not considered practicable, or even desirable, to secure teachers who have had actual engineering experience. One reason advanced is that the pecuniary rewards in engineering practice are so much greater than in teaching that it is impossible to secure desirable experienced engineers as teachers. It is also thought that practical experience extending over a number of years would actually disqualify one for teaching by putting him out of touch with college life and out of sympathy with the best educational methods and ideals. It is admitted, however, that the teacher of mathematics to engineers should have an adequate knowledge of the applications of the subject, as otherwise he would be out of sympathy with the aims of the school.

The cause of the difficulty experienced in securing satisfactory teachers in this field probably lies in the natural scarcity of men who prefer teaching to professional work, the preference naturally connecting itself with aptitude.

The most efficient training for a teacher of mathematics in a technological school is believed to consist of a technical collegiate education, or academic course with the election of numerous technical courses involving the applications of mathematics, followed by graduate work in pure mathematics. Previous teaching experience is thought to be desirable but not essential.

It is emphatically asserted that mathematics should be taught by skilled mathematicians. The argument is that greater technical skill is required in mathematics than in any department of technology, and if the latter requires the services of specialists, mathematics can also be best imparted by experts in this particular line.

SUPPLEMENT ON SPECIAL METHODS OF INSTRUCTION.

I. THE TWO-HOUR SYSTEM AT HARVARD UNIVERSITY.

E. V. Huntington.

In certain courses in mathematics for undergraduates at Harvard University a special plan of instruction is followed which meets several important requirements in a large university.

Each large course (50 to 100 students) is in charge of a permanent member of the staff, assisted by two or more instructors recruited each year from the ranks of the graduate students. The course meets three times a week for two consecutive hours. In the first part of the period the professor in charge lectures to the entire class, explaining the method for solving the problems of the day. In the second part of the period the class moves into a large drafting room, where the students work out their problems under the immediate supervision of the instructors. That is, the three instructors, including the professor in charge, pass about the room from man to man, giving each man a brief individual conference on his work while the work is being done. These conferences are partly in the nature of a quiz, to make sure that the student is able to explain intelligently what he is doing; partly to give assistance over special individual difficulties; and partly to record the problem work. For this last purpose special individual record cards are kept. With these cards in his hand, the instructor has the complete record of each student before him when he approaches that student for his conference. No problems are "handed in" to be corrected out of hours; all the problem work done by the student remains in his notebook and is inspected and recorded by the instructor in his presence.

The work in the drafting room is quite informal, and the students are at liberty to discuss their problems with their neighbors. An essential feature of the plan, therefore, is a series of frequent short tests, usually every two weeks, in which each student works by himself. The marks for the course are chiefly based on these tests and on the usual mid-year and final examinations.

The chief advantages of the plan are that any difficulties the student may experience are cleared up at once; the instructor is enabled to keep in close and constant touch with the work of the class; and the university is able to avail itself of the services of experienced teachers who are taking graduate work on leave of absence from their own institutions, and are thus eligible for such temporary appointments.

II. REDIRECTION OF EDUCATIONAL AIMS.

S. E. Slocum.

From the facts brought out by the questionnaire it would seem that mathematical instruction in technological departments of colleges and universities has not yet diverged very widely from the lines laid down as orthodox half a century ago or more, and originally intended as preparatory for one of the so-called learned professions. The rapid industrial development of recent years, however, has created a demand for a highly efficient and specialized form of technical training, in response to which a new type of school has arisen, known variously as trade, technical, manual, vocational, commercial, industrial, continuation or cooperative. This has been accompanied by a radical revision of academic standards, the popular ideal, at least, being that of a training which fits directly for industrial and social efficiency. This is evidenced not only in individual efforts at modification of the curriculum in many of our own institutions, but also in recent government legislation in Great Britain, France, and Germany.

The appointment of this commission is, in itself, a recognition of the fact that a new educational situation has arisen which demands special consideration, and the value of its reports will consist largely in informing teachers generally of the trend of our American educational policy and in harmonizing cultural ideals with the practical demand for industrial and social efficiency. To further supplement the returns to the questionnaire it therefore seems desirable to point out the most salient features of the new problem in technological education as apparent in the scheme of industrial cooperation, with special reference to its practical effect on mathematical instruction.

THE COOPERATIVE SYSTEM AT THE UNIVERSITY OF CINCINNATI.

The effect of any popular propaganda, such as the demand for vocational efficiency referred to above, is of course first apparent in secondary education, but, although of comparatively recent origin, the movement already shows an outcropping at the university level in several places, notably in the cooperative system established at the Lewis Institute, Chicago, and at the University of Cincinnati. The basis of this innovation is usually supposed to consist in the simple fact of mechanical alternation between school and shop, whereby a manual as well as an intellectual development is secured, and a trade acquired simultaneously with a profession. A more adequate and characteristic summary of the ideas underlying the cooperative system, however, is that given in the following extract from a recent article on the subject:

> A definite line of communication has been established from the school to the forge and shop and railroad; from the laboratory and lecture hall, where the laws underlying and governing the work are formulated and made clear, to where men actually face

the problems of progress. The embryo engineer travels back and forth between the two weekly, and always faces the task before he is brought to the science. The laws of nature, then, have for him an increased significance. Literature and the humanities have life. Fact and theory are in constant juxtaposition. That strength is gained which we call character, and a safe mental development based on physical effort is obtained in conformity to nature's laws. "Going to college" every other week from the workshop has a different meaning from "going to college" once from the high school. It becomes an opportunity that is denied other men in overalls and jumpers, and a corresponding feeling of indebtedness to the one not so favored develops. It means future cooperation rather than future misunderstanding and mutual distrust. We have applied the term "cooperative system" to this method of training as much in hope of its future results as in description of the method.

EFFECT OF THE COOPERATIVE SYSTEM ON MATHEMATICAL INSTRUCTION.

It is obvious that such an intimate correlation of the concrete with the abstract is bound to affect both the form and content of instruction, especially in the case of a basic science like mathematics. As an instance of this, the result of five years' operation of the cooperative system at the University of Cincinnati shows an increasing tendency to break down the barriers between departmental instruction in mathematics and allied subjects, particularly mechanics. Increasing emphasis is thereby laid upon mathematics as a general method, or, from another point of view, as the unifying principle underlying all branches of technology. The practical development of this idea in mathematical instruction in connection with the cooperative system has been gradual, accompanying the growth of the general scheme of correlation of departments and shops. Sufficient progress has already been made, however, to show that eventually the principles of elementary mechanics will be used for unifying mathematical instruction and correlating it with the manual experience of the student, as well as with other branches of technology. Effectual provision will thus be made for laboratory instruction in mathematics, long thought to be desirable, but difficult of satisfactory attainment.

In mechanics, which is taught by a separate department of applied mathematics, the cooperative viewpoint was adopted at the outset, although improvements in method are still being made. In detail, the method consisted primarily in urging each cooperative student to bring to the classroom for solution each week some practical problem in mechanics or the strength of materials which had come under his observation in the shop during the previous week. This simple plan for securing the active cooperation of the student in his own instruction put him in a receptive mental attitude, and at the same time greatly increased the practical and informational value of the course. By this method, individualizing of instruction, which hitherto has been an ideal rather than a reality, appears spontaneously, without effort on the part of the teacher, and the elimination of memory work is accompanied by a concentration of attention on methods and processes rather than their outcome. The most important features of this plan are that the student and his activities become the center of interest and his intellectual and manual activities so articulated as to act as mutual stimuli.

There can be no doubt that the current of modern educational thought is setting strongly in the direction of practical cooperation such as here indicated, as shown, for instance, by the results of the investigation carried out by the Manuel Général in France, and the impression which such men as Dr. Kerschensteiner, of Munich, are making upon the educational policy of Germany. The changes advocated, however, are not as radical as may appear at first sight, and no fear need be entertained as to the loss of any of the so-called cultural value of mathematical instruction if by culture is understood a well-rounded development of the individual rather than intellectual conformity to a rigid Procrustean standard.

CONCLUSION.

The facts here presented indicate that orthodox instruction in mathematics does not entirely harmonize with present ideals of material development. In justice to present methods it should be said, however, that this by no means implies that instruction in mathematics is less efficient than in other subjects. A comparison of results with those obtained in other departments, such as English or physics, will show no greater returns for a given expenditure of time and energy. The greater prevalence of criticism of mathematical instruction arises chiefly from the fact that any deficiency in this subject is more apparent than in others, as mathematics precedes technological subjects and serves as their basis. Moreover, the inability to use mathematical principles once taught may be more apparent than real, since it will often be found that when these principles are needed for application a brief explanation by the instructor in technology will suffice to recall them with all their original force.

There is perhaps more ground for the criticism that mathematical instruction at present is too formal and better suited to the needs of a specialist in mathematics than to a student of technology. The idea of formal discipline as an educational aim is, in fact, a thing of the past. A sufficient evidence of its futility in the present case is the difficulty which the average student experiences in making even simple technical applications of mathematical principles in which he has been carefully drilled. On the other hand, the fear that technical applications will lessen the cultural value of mathematics is groundless, as a principle or problem loses none of its theoretical importance because it also has a human or economic value. For instance, in such a prosaic field as shop management the well-known Taylor system has resulted in the development of a slide rule for handling 12 variables simultaneously, and the fact that its use increases the output of a machine 50 per cent by no means lessens its importance as an achievement of mathematical genius.

The whole question seems to resolve itself into the problem of making mathematics more expressive of modern conditions. Herbart asserts that interest is of fundamental pedagogical importance, and that interest is based on apperception, by which he means that no instruction can be assimilated until its relation to concepts already familiar is fully apparent. This indicates that even from a purely pedagogical standpoint mathematical instruction should proceed slowly and each new idea be followed out into as many of its ramifications as possible in order to provide the connective tissue needed to make education organic. It is suggested, therefore, that effort be directed toward making instruction in mathematics cumulative; that is to say, instead of placing the chief emphasis on the logical development of the subject and relying for practice on sets of unrelated problems illustrating merely a single phase or principle, its importance as the unifying principle underlying all exact methods of expression should be made apparent by a series of original applications of increasing complexity, each of which shall embody as much as possible of all preceding instruction in the subject. A graded series of practical problems in mechanics and engineering design arising out of the student's growing experience is typical of what is meant. Less ground might apparently be covered in this way, but there can be no doubt that the ordinary student would make more substantial and lasting progress.

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BIBLIOGRAPHY OF EDUCATION FOR 1909–10

INTRODUCTION

The bibliography of education for 1909–10, as was its immediate predecessor in the series, has been compiled in the library division of the Bureau of Education, which has been aided, in completing the principal sections of the list, by criticisms and additions furnished by prominent educational specialists. In addition to these collaborators in special classes, the entire bibliography, in its preliminary form, was submitted for revision and additions to the librarians of two of the leading pedagogical collections in the country outside of Washington.

A period marked by extensive and excellent literary productivity in education, namely, that reaching from July 1, 1909, to June 30, 1910, falls within the scope of this bibliography, but for special reasons a few important titles published earlier or later than these dates have been included.

The aim has been to present a thoroughly representative selection from the main classes of educational literature published in English during this period. Of publications in foreign languages, those which were judged to have special significance for American educators have been mentioned.

It is believed that the list here given of current proceedings and reports of educational associations will be found especially comprehensive. References have also been made to a considerable number of State and city school documents of importance appearing during the year. Wherever found desirable and practicable, descriptive and critical annotations, either original or quoted from authoritative reviews, have been appended to the titles of books or articles.

A detailed outline of the classification, which, with a few variations, follows that of the Library of Congress for Class L, Education, may be found in the table of contents.

BIBLIOGRAPHY OF EDUCATION, 1909-10

[The abbreviations used in periodical and serial references are ordinary ones and easily comprehended. Volume and page are separated by a colon. Thus 6 : 386-407 means vol. 6, pages 386 to 407.]

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76. **American federation of arts.** *See* 1430, 1431.

77. **American home economics association.** *See* 1414.

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Contains: 1. H. C. Morrison: Federation of New England educational associations, p. 87–89. 2. T. F. Harrington: The health of school children, p. 89–90. 3. H. E. Bates: Co-operation in education, p. 91. 4. John Golden: The educational need from the viewpoint of organized labor, p. 91–92. 5. Julius Tuckerman: Symbols and substance in modern language teaching, p. 92–93. 6. F. B. Jenks: Practical agriculture in rural schools, p. 93–94. 7. W. E. Mason: Children's gardens, p. 94–95. 8. H. P. Waterman: Some results of industrial teaching, p. 95–96. 9. A. C. Boyden: Report on the organization, courses, and methods of some normal schools of the Middle West, p. 96–97. 10. J. E. Mowry: Essentials of arithmetic below the high school, p. 97, 102. 11. W. E. Russell: The problem of industrial education in the normal schools, p. 102–3. 12. G. H. Whitcher: Industrial education in an ordinary high school, p. 103–4.

79. **American nature-study society.** *See* 602.

80. **American school hygiene association.** *See* 1045.

81. **American school peace league.** *See* 1279.

82. **American society of superintendents of training schools for nurses.** *See* 1452, 1453.

83. **Association of American agricultural colleges and experiment stations.** *See* 1397.

84. **Association of American law schools.** *See* 1436.

85. **Association of American medical colleges.** *See* 1440.

86. **Association of American universities.** *See* 793.

87. **Association of colleges and preparatory schools of the middle states and Maryland.** *See* 794.

88. **Association of colleges and preparatory schools of the southern states.** *See* 795, 796.

89. **Association of collegiate alumnae.** *See* 1463.

90. **Association of cosmopolitan clubs.** *See* 900, 901.

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93. **Child conference for research and welfare.** *See* 491.

94. **Classical conference.** *See* 1286.

95. **Conference for education in the South.** Proceedings of the twelfth conference, Atlanta, Georgia, April 14–16, 1909. Nashville, Tennessee, The Executive committee of the Conference [1909] 235 p. 8°. (Wickliffe Rose, secretary, Nashville, Tenn.)

Contains: 1. Hoke Smith: Address of welcome, p. 12–17. 2. R. C. Ogden, president: Address, p. 17–29. 3. S. C. Mitchell: The American spirit in education, p. 29–35. 4. J. M. Pound: Educational progress of the year in the southern states, p. 36–69. 5. G. B. Cook: The agricultural and industrial educational movement in the South, p. 69–84. 6. E. E. Brown: The national program in education, p. 84–97. 7. Clarence Ousley: The educational campaign in Texas, p. 98–111. 8. J. L. Coulter: Economic organization of rural life, p. 112–29. 9. Gifford Pinchot: National progress in country life, p. 129–31. 10. Mrs. B. B. Munford: The southern woman's work for education; a record and interpretation, p. 132–39. 11. Lilian W. Johnson: The woman's club as a factor in education, p. 139–44. 12. Mrs. R. E. Park: The educational work of the club women of Georgia, p. 144–48. 13. Lida S. King: The higher education of women, p. 149–56. 14. C. L. Coon: Public taxation and the negro school, p. 157–67. 15. A. C. Ellis: Education and economic development, p. 171–86. 16. C. R. Van Hise: The state university in the service of the state, p. 186–97. 17. P. P. Claxton: A school for grown-ups, p. 198–203. 18. J. Y. Joyner: How the Southern education board has helped and can help the South, p. 209–13.

96. **Conference for education in the South.** Proceedings of the thirteenth conference, Little Rock, Arkansas, April 6, 7, 8, 1910. Washington, D. C., The Executive committee of the Conference [1910] 352 p. 8°. (P. P. Claxton, secretary, Knoxville, Tenn.)

Contains: 1. G. W. Donaghey: Address of welcome, p. 9–11. 2. R. C. Ogden, president: Address p. 12–30. 3. L. D. Harvey: The training of girls for the home, p. 31–48. 4. J. N. Powers: Report of the year's progress in public education in each of the southern states, p. 50–63. 5. C. A. Cobb: What one southern county agricultural high school has done and is doing, p. 64–69. 6. J. Y. Joyner: The adjustment of the rural school to the conditions of rural life as observed in the rural schools of Page county, Iowa, p. 69–76. 7. J. D. Eggleston, *jr.*: Consolidation by transportation, p. 76–92. 8. T. H. Harris: Unifying the county school system, p. 93–100. 9. A. M. Soule: Education for efficiency in rural communities, p. 101–29. 10. R. E. Blackwell: The function and the future of the small college in the South, p. 129–44. 11. R. H. Lewis: Education and the public health, p. 145–59. 12. H. F. Cope: Religion and education, p. 160–63. 13. W. R. Hollowell: Social improvement leagues; what they are doing and what they may do, p. 164–73. 14. Mrs. T. P. Murrey: The work of school improvement in Arkansas, p. 173–76. 15. Mrs. J. Fletcher: What club women are doing for schools in Arkansas and what they may do, p. 176–80. 16. H. T. Bailey: Community improvement through the school-home, p. 180–85. 17. R. L. Owen: The conservation of our national vitality, p. 190–95. 18. J. C. Branner: Education for economic efficiency, p. 196–209. 19. H. L. Russell: What education is doing for Wisconsin, p. 210–15. 20. F. L. Stevens: Agriculture in the elementary school, p. 219–24. 21. J. J. Doster: Agriculture in public high schools, p. 225–33. 22. C. A. Keffer: What the college of agriculture can do to promote the teaching of agriculture in the rural schools, p. 233–42. 23. D. B. Johnson: Agriculture in normal schools, p. 242–50. 24. C. S. Barrett: America's destinies and the education of the farmer, p. 250–53. 25. S. A. Knapp: How can the masses be induced to adopt a better system of agriculture? p. 253–58. 26. R. C. Stearnes: An excursion among western schools, p. 291–98. 27. J. N. Powers: County schools of agriculture and domestic science in Wisconsin and what they mean to the people, p. 298–301. 28. H. C. Gunnels: Boys' corn clubs, p. 301–4. 29. G. B. Cook: Development and significance of industrial cooperation, p. 304–8. 30. J. G. Crabbe: A great university in the service of the people—seed selection, p. 308–16.

97. **Conference for the study of the problems of rural life.** *See* 547, 548.

98. **Conference on agricultural science.** *See* 1398.

99. **Eastern association of physics teachers.** *See* 724–726.

100. **Eastern manual training association.** *See* 1312, 1432.

101. **Lake Mohonk conference of friends of the Indian and other dependent peoples.** *See* 1488.

102. **Lake Mohonk conference on international arbitration.** *See* 1280.

103. **National association for the study and education of exceptional children.** *See* 1525.

104. **National association of state universities.** *See* 797.

105. **National child labor committee.** *See* 1200.

106. **National conference on the education of backward, truant, and delinquent children.** *See* 1526.

107. **National education association of the United States.** Journal of proceedings and addresses of the forty-seventh annual meeting, held at Denver, Colo., July 3–9, 1909. Winona, Minn., The Association, 1909. xi, 1027 p. 8°. (Irwin Shepard, secretary, Winona, Minn.)

General session

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108. **National education association of the United States. Department of superintendence.** Proceedings of annual meeting held at Indianapolis, Ind., March 1–3, 1910. [Winona, Minn.] The Association, 1910. 179 p. 8°.

Contains: In memoriam—William Torrey Harris, by George P. Brown, Charles P. Cary, and Elmer Ellsworth Brown. Discussion of the following topics: Differences of children in mental alertness, moral responsibility, mental attitudes, tastes and tendencies, physical condition, environment, vocational aim; The country child; Purpose and content of the elementary curriculum; Grading and promotion of pupils.

109. **National society for the promotion of industrial education.** *See* 1337.

110. **National society for the study of education.** *See* 1065.

111. **National society of college teachers of education.** *See* 785.

112. **Playground association of America.** *See* 1112.

113. **Religious education association.** *See* 1232.

114. **Society for the promotion of engineering education.** *See* 1428.

115. **Southern association of college women.** *See* 1465.

116. **Southern educational association.** Journal of proceedings and addresses of the nineteenth annual session, held at Atlanta, Georgia, December 29–31, 1908. [Chattanooga, Tenn.] The Association [1909] 736 p. 8°. (William F. Feagin, secretary, Montgomery, Ala.)

Contains: 1. M. L. Brittain: The rural school house, p. 59–62. 2. P. P. Claxton: A review, a condition, a task, p. 85–90. 3. H. S. West: A formula for method in high school English literature, p. 91–97. 4. Nettie C. Sergeant: Theme writing in the high school, p. 98–106. 5. F. L. Riley: History in the high school, p. 107–15. 6. T. J. Jones: Relation of the state to the education of the negro, p. 116–20. 7. J. H. Phillips: Essential requirements of negro education, p. 121–29. 8. J. H. Dillard: Negro rural schools, p. 130–35. 9. C. F. Meserve: Results of attempts at the higher education of the negro of the South, p. 136–44. 10. C. J. Owens: Agricultural education in the United States, p. 149–56. 11. C. B. Gibson: Recent tendencies towards industrial education in Europe and America, p. 157–66. 12. Julia T. Rankin: Trained librarianship in the South, p. 167–73. 13. R. J. Tighe: Compulsory school attendance in Asheville, N. C., p. 174–80. 14. Emma G. Boyd: Compulsory education, p. 181–83. 15. Wickliffe Rose: Education as a public business, p. 184–90. 16. J. C. Olmstead: Medical inspection of school children for contagious and infectious diseases, p. 200–5. 17. Dunbar Roy: Necessity for proper care of school children's eyes and ears, p. 206–18. 18. C. E. Boynton: Education of the backward child—a psychological study, p. 219–25. 19. W. B. Murrah: Right views of education, p. 226–34. 20. H. L. Smith: A conspicuous fault in modern university training, p. 235–40. 21. C. W. Needham: The university's service to the state, p. 241–52. 22. W. W. Smith: Student self-government, p. 253–58. 23. R. P. Pell: The college professor and the community, p. 259–67. 24. A. P. Montague: The teacher's place in the American commonwealth, p. 268–72. 25. E. M. Poteat: The denominational college, p. 273–78. 26. P. H. Mell: College attitude toward the high school, p. 279–82. 27. J. P. Monaghan, S. J.: True aim in scientific education, p. 283–306. 28. J. E. Allen: Status and dignity of secondary education in the South, p. 310–24. 29. John Graham: Relation of the high school to the state and college, p. 325–27.

30. T. P. Scott: Two-fold function of the high school, p. 328–35. 31. Wallace Townsend: The high school as a factor in the community, p. 336–46. 32. W. E. Miller: The high school as a preparation for life work, p. 347–59. 33. J. P. W. Brouse: Individuality of the high school, p. 360–65. 34. R. A. Wells: Why are the public schools so severely criticised? p. 366–80. 35. G. W. Lay: Intelligent and honest standards in secondary education, p. 381–90. 36. I. W. Jayne: A high school for the country boy and girl, p. 391–98. 37. C. L. Coon: A suggestion to promote rural high school development, p. 399–401. 38. William Schuyler: The so-called culture studies in secondary education—some questions, p. 402–5. 39. P. R. Radcliffe: Aims of the recitation, p. 406–12. 40. J. R. Powell: Rational high school course of study for modern complex conditions, p. 413–21. 41. R. H. Jordan: Some advantages of a group system of electives in a high school course of study, p. 422–29. 42. B. C. Caldwell: Relation of the model, practice, or training school to the work of the normal school, p. 435–39. 43. J. L. Jarman: Relation of heads of departments to supervisors or critic teachers, p. 440–44. 44. H. H. Cherry: Democracy and education, p. 445–50. 45. R. J. Tighe: Women's clubs in cooperation with the public schools, p. 453–58. 46. M. A. Cassidy: Use of school buildings and grounds aside from regular school sessions, p. 459–62. 47. E. L. Hughes: Supervision of negro schools, p. 463–69. 48. L. M. McCartney: Efficiency of teachers, p. 470–74. 49. G. G. Bond: Evolution of pedagogy, p. 475–81. 50. P. W. Horn: Relation of the city schools to the commission form of city government, p. 482–90. 51. I. C. McNeill: The delinquent child, p. 491–98. 52. C. B. Chapman: What is the hope of compulsory education in the elementary schools? p. 508–13. 53. J. H. Reynolds: Agricultural high schools, p. 515–25. 54. P. A. Hopkins: Relation of manual training to the technical school, p. 526–29. 55. J. C. Mattoon: Common schools from an industrial standpoint, p. 530–40. 56. M. T. Fullan: Advantages of the trade school over the apprenticeship system, p. 541–50. 57. E. C. Emerson: The large project vs. the small model, p. 551–54. 58. Marion L. Baskin: Educational value of gymnastics, p. 567–74. 59. Ellen Reiff: Construction work in relation to mind growth, p. 617–21. 60. Lillian Rule: Handwork in the first four years of school, p. 622–28. 61. G. H. Baskette: The library as a factor in education, p. 641–45. 62. J. N. Deahl: Value of child study for parents, p. 649–52. 63. Maude M. Shipe: Play the legitimate business of childhood, p. 653–60. 64. H. J. Pearce: Interrelation of suggestibility and intelligence p. 665–71. 65. Max Meyer: A neglected method of examination, p. 672–77. 66. W. T. White: Some mentally defective children in our public schools, p. 678–82. 67. W. I. T. Hoover: Psychology in secondary education, p. 683–86. 68. Miss C. P. Oppenheimer: Relation of the kindergarten to the home, p. 695–700.

117. **Western drawing and manual training association.** *See* 1313, 1314.

118. **Women's educational and industrial union.** *See* 1466, 1467.

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119. **Alabama educational association.** Official proceedings of the twenty-ninth annual session, . . . held at Birmingham, March 24–26, 1910. [Birmingham, 1910] 331 p. 8°. (W. C. Griggs, secretary, Birmingham, Ala.)

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120. **Arkansas state teachers' association.** Proceedings of the forty-second annual session . . . Hot Springs, December 28th, 29th, and 30th, 1909. Little Rock, Ark., 1910. 253 p. 8°. (Henry S. Traylor, secretary, Booneville, Ark.)

Contains: 1. Committee on code of ethics: Report, p. 28-32. 2. H. S. Hartsog: Educational evangelism, p. 36-45. 3. G. B. Cook: The attitude of Arkansas toward public education, p. 46-54. 4. J. J. Doyne: Education for efficiency, p. 55-62. 5. B. W. Torreson: Needs of a higher education, p. 63-65. 6. W. D. Johnson: The Arkansas teachers' reading circle, p. 66-71. 7. G. R. Hopkins: How may we secure more male graduates from the high schools? p. 72-73. 8. B. F. Condray: Should we have a uniform curriculum for high schools in Arkansas? No. p. 74-75. 9. R. J. Nelson: Industrial training—its benefits—how may it be introduced into the public schools? p. 76-78. 10. J. A. Presson: How may the superintendent test the quality of the teacher's work? p. 79-82. 11. F. G. May: How may the superintendent test the quality of the teacher's work? p. 83-85. 12. C. F. Adams: Agriculture in the collegiate and professional worlds, p. 97-101. 13. J. H. Reynolds: Conservation of the soil, p. 102-12. 14. C. C. Denney: The relation that the state normal sustains to the high schools and colleges of the state, p. 116-20. 15. B. W. Torreyson: The high school situation in Arkansas, p. 121-23. 16. W. B. Loudermilk: How to secure more accurate reports from school directors and county examiners, p. 124-30. 17. J. P. Womack: Student self-government, p. 136-38. 18. J. R. Williamson: Student government, p. 139-40. 19. J. C. Futrall: Some defects in the teaching of Latin in the secondary schools, p. 146-51. 20. O. E. Williams: Suitable libraries for the grades; how secured; how preserved; how made useful, p. 168-70. 21. W. J. Sowder: Outline course for agriculture in the graded schools, p. 189-96. 22. Mrs. F. M. Williams: How can the home and the school be brought into closer relations, p. 231-32.

121. **Brown university teachers' association.** Proceedings, 1910. Education, 30 : 609-93, June 1910. (Elmer T. Hamer, president, Pawtucket, R. I.)

Contains: 1. W. H. P. Faunce, president: Greeting, p. 609-10. 2. A. A. Holden: Survival of the freshmen in New England colleges, p. 611-15. 3. F. W. Nicolson: College failures: the responsibility of the school and the home, p. 617-31. 4. D. W. Abercrombie: The responsibility of the college for the freshman, p. 632-48. 5. C. E. Dennis, jr.: Report of Committee on college entrance requirements, p. 649-60. 6. J. S. French: How to secure from the pupil initiative and independent effort, p. 661-69. 7. S. H. Rowe: The study habit and how to form it, p. 670-83. 8. F. M. McMurry: Relative values in study, and the basis for judging them, p. 684-92. 9. Maud E. Kingsley: Examination questions for Homer's Odyssey, p. 692-93.

122. **California. City and county superintendents.** Proceedings of the first annual convention, held near Yosemite Falls, August 23-28, 1909. Western journal of education, 14: 427-63, September 1909.

Contains: James Ferguson: Commercial education in the United States and abroad, p. 452-63.

123. **California council of education.** Committee on permanent organization. Report, adopted at Fresno, March 12, 1910. Sierra educational news and book review, 6: 35-43, April 1910. (Mark Keppel, secretary, Los Angeles, Cal.)

124. **Conference for education in Texas.** Proceedings of the third annual session, Austin, Texas, March 26-27, 1909. Austin, Austin printing company [1909] 110 p. 8°. (A. N. McCallum, secretary, Austin, Tex.)

Contains: 1. S. E. Mezes, J. L. Kesler: What must be done in order that the people of Texas may enjoy the privileges of an efficient State system of public schools? p. 11-18, 18-31. Discussion (by R. B. Cousins), p. 31-36. 2. D. M. Alexander: The thirtieth legislature in educational history, p. 37-43. 3. M. L. Hurst: The movement for local taxation, p. 44-50. Discussion, p. 50-60.

4. F L. Townsend: The farmers' interest in better schools for all the children of the State, p. 62–73. 5. J S. Austin: The laborers' interest in better schools for all the children of the State, p. 74–79. 6. M. A. Spounts: The property-holders' interest in better schools for all the children of the State, from the standpoint of the railroads, p 80–85. 7. C. E. Evans: The work of the second year and the program for the third year, p. 86–91 Discussion, p. 91–99. 8. A. C. Ellis: The problem of modern school buildings in Texas, p 99–109.

125. **Conference for education in Texas. Educational commission.** *See* 922.

126. **Georgia educational association.** Proceedings and addresses of the forty-third annual meeting at Cumberland Island, Ga., June 23, 1909. Waldosta, Ga., Times publishing company, 1909. 65 p. 8°.

Contains: 1. O. B. Martin: Public school extension work, p. 26–35. 2. C. B. Gibson: Waste in education, p. 36–40. 3. Mrs. W. B. Hill: Better educational facilities, p. 49–52. 4. J. I. McCleskey: Consolidation of rural schools, p. 53–58. 5. O. Ashmore: The problem of the slow pupil, p. 59–65.

127. ——— Proceedings and addresses of the forty-fourth annual meeting, Atlanta, Ga., April 28–30, 1910. Macon, Georgia, The Anderson printing co., printers, 1910. 185 p. 8°. (Clifford L. Smith, secretary, 1910–11, La Grange, Ga.)

Contains: 1 E. A. Pound: Causes of failure in teaching, p. 35–47. 2. J. N. Rogers: Agricultural education in the public schools, p. 48–52. 3. D. B. Johnson: Southern ideals: Why they should be maintained in the education of southern women, p. 53–58. 4. K. G. Matheson: Some thoughts concerning the effect of technical education upon the prosperity of the South, p. 59–69. 5. M. L. Duggan: Our rural school problems, p. 70–72. 6. Mrs. F. F. Andrews: The teacher and internationalism, p. 73–80. 7. A. J. Cobb: The needs of secondary schools in Georgia, p. 81–84. 8. G. A. Persons: The needs of secondary schools in Georgia, p. 85–90. 9. J. S. Stewart: The needs of secondary schools in Georgia, p. 91–97. 10. R. B. Daniel: Industrial education in the grammar schools, p. 110–14. 11. D. C. Barrow: Standardization of higher education, p. 115–22. 12. J. F. Sellers: Standardizing our colleges, p. 122–29. 13. H. B. Hunt: The functions of the high school, p. 130–32. 14. A. M. Soule: The functions of the high school, p. 132–39. 15. R. H. Powell, jr.: The function of the college in the preparation of teachers, p. 140–43. 16. E. C. Emerson: The problem of holding the boy in the high school, p. 143–52. 17. K. T. Alfriend: The problem of holding the boy in the high school, p. 152–56. 18. T. H. Garrett: Planning the high school course, p. 157–64. 19. C. L. Smith: The duty of the State to her secondary schools, p. 165–68. 20. G. I. Orr: The teaching of English in elementary schools, p. 169–75. 21. T. J. Woofter, chairman: Report of committee on legislation and the betterment of the profession of teaching, p. 175–79.

128. **High school teachers' association of Los Angeles.** *See* 642.

129. **High school teachers' association of New York city.** *See* 643, 644.

130. **Illinois state teachers' association.** Journal of proceedings of the fifty-fifth annual meeting, held at Springfield, Illinois, December 29–31, 1908. Springfield, Illinois, Illinois state journal co., state printers, 1909. 219 p. 8°.

Contains: 1. F. G. Blair: The educational commission and the school system, p. 36–44. 2. F. H. Hall: The township as the unit of school organization, p. 44–49. 3. E. E. Van Cleve: Effect of proposed legislation upon township high schools, p. 49–51. 4. O. L. Manchester: The work of the educational commission, p. 51–57. Discussion, p. 57–59. 5. J. W. Cook: Memorial address—Richard Edwards, A. M., LL. D., p. 59–68. 6. J. E. Miller: Memorial: Honorable James P. Slade, p. 69–73. 7. R. M. Hitch: Memorial: Homer Bevans, p. 73–76. 8. D. E. Smith: The present tendency in arithmetic, p. 81–95. 9. M. M. Cook: The county superintendent and the proposed new certificate law, p. 114–20. Discussion, p. 120–22. 10. May S. Hawkins: The proposed minimum wage law and the country schools, p. 125–26. 11. G. T. Smith: Certification of teachers, p. 130–34. 12. F. M. Richardson: Minimum wage scale for teachers, p. 134–38. 13. W. C. Bagley: Recent result and tendencies in child study, p. 147–52. 14. F. G. Bonser: Vocational work below the high school in its bearing on the growing ideal interests of children, p. 153–58. 15. J. E. Raycroft: The function and administration of medical supervision in the school, p. 158–63. 16. Ella T. Price: A standard of morals for primary children, p. 167–71. 17. Eva A. Smedley: A standard of morals for primary children, p. 171–74. 18. Helen M. Sabin: The ethical value of handwork, p. 174–78. 19. Anna H. Morse: Kindergarten certificates, p. 178–80. Discussion, p. 180–83. 20. E. A. Turner: The certification of teachers, p. 192–95. 21. C. H. Brittin: The proposed certificating law, p. 200–2.

131. ——— Journal of proceedings of the fifty-sixth annual meeting, held at Springfield, Illinois, December 28–30, 1909. Springfield, Ill., Illinois state journal co., state printers, 1910. 271 p. 8°. (Caroline Grote, secretary, Macomb, Ill.)

Contains: 1. C. M. Bardwell: President's address, p. 66–68. 2. F. G. Blair: Results of the work of the educational commission, p. 68–75. 3. A. E. Winship: The schools and the critics, p. 75–78. 4. D. W. Potts: The relation of motor to mental activity, p. 78–99. 5. David Felmley: The educational value of manual training, p. 99–104. 6. F. D. Crawshaw: What to consider in introducing manual training in a school, p. 104–10. 7. Mrs. F. E. Clark: A modern Apollo [school music], p. 122–29. 8. Rabbi Leon Harrison: The gospel of hard work—What hard work does for us: how it educates us, p. 129–34. 9. W. N. Clifford: How forestry can be taught in the school, p. 134–37. 10. U. J. Hoffman: Experiences in standardizing country schools, p. 144–46. 11. E. C. Pruitt: Setting up a definite aim, p. 146–48. 12. D. F. Nickols: Standardization of rural schools—the effect on the teacher, p. 148–50. 13. Leona F. Bowman: Value of country school inspection by the State department to the county superintendent, p. 150. 14. Charles McIntosh: The county institute—State aid, p. 151–54. 15. F. A. Gilbreath: Time of holding annual institutes, p. 155–58. 16. A. F. Nightingale: How to obtain good instructors for institutes, p. 158–62. 17. W. C. Bagley: The possibility of training children how to study, p. 167–73. 18. L. A. Fulwider: A cooperative school and shop course, p. 179–87. 19. J. D. Rogers: The content of the course of study leading to the B. A. degree, p. 188–94. 20. H. B. Wilson: The beginning of medical inspection in Illinois, p. 196–200. 21. E. T. Davies: Enforcement of the law concerning child labor, p. 200–7. 22. Charles Virden: A review of the social and educational agencies for the amelioration of the conditions of childhood now operative in Illinois—finding, placing and supervision of dependent and delinquent children of the State, p. 208–11. 23. Caroline Hedger: Some problems of sanitation in the public schools of Chicago, p. 211–14. 24. E. A. Wygant: Morality taught through plays and games, p. 216–18. 25. M. L. Hood: Morality taught in the general management of the school, p. 218–19. 26. Mrs. J. E. Warren: Practical methods in sight singing, p. 221–23. 27. H. A. Hollister: Character and scope of the work of an accredited high school, p. 225–29. 28. Mrs. O. T. Bright: The aims of the congress of mothers' clubs, p. 230–31. 29. Mrs. W. S. Hefferan: Home training of children, p. 231–33. 30. F. G. Bonser: Where parents fail in the education of children from the school's point of view, p. 233–38. 31. Stuart Brown: Some aspects of school training as viewed by the business man, p. 238–41. 32. F. G. Bonser: What should be the attitude of the normal school toward industrial education? p. 243–50.

132. **Indiana state teachers' association.** Proceedings and papers of the fifty-sixth session, December 28, 29, 30, 1909, Indianapolis, Indiana. [Indianapolis, 1910] 152 p. 4°. (J. B. Pearcy, permanent secretary-treasurer, Anderson, Ind.)

Contains: 1. R. J. Aley: Institutional responsibility, p. 27–30. 2. Symposium: Some needed school adjustments, p. 30–42. 3. J. R. Carr: The rural school: its improvement, p. 55–57. 4. J. W. Figg: Improvement of rural school—patron's part, p. 57–58. 5. Oscar Thomas: What the teacher can do to improve our rural schools, p. 58–59. 6. J. N. Hurty: How the board of health can assist in improving the rural school, p. 59–60. 7. W. W. Black: How the county institute instructor can help the rural school, p. 61–62. 8. W. O. Wilson: The township institute, p. 62–64. 9. R. N. Tirey: County supervision supplementary to visitation, p. 65–67. Discussion, p. 67–68. 10. J. C. Webb: Work of the county board of education, p. 68–70. 11. A. E. Highley: History of the correlation of mathematics, p. 70–71. 12. W. W. Hart: Correlation of mathematics in grade school and high school, p. 71–73. 13. Francis Daniels: The influence of French on English, p. 79–81. 14. E. H. Biermann: Some problems connected with the teaching of German in high schools, p. 82–84. 15. C. B. McLinn: The teaching of poetry in high school, p. 85–87. 16. C. D. Mead: Head, heart, or hand with the deficient child? p. 89–91. 17. H. M. Appleton: Classroom problems for the manual-training teacher, p. 91–93. 18. Laurinda De Vilbiss: Domestic science in the public schools, p. 93–95. 19. L. A. Pittenger: Training of high-school teachers, p. 95–96. 20. J. E. Neff: The academic preparation of the high-school teacher, p. 96–99. 21. T. A. Mott Richmond: Modifications of the work of the seventh and eighth grades, p. 99–101. 22. R. Katharine Beeson: Poetry in the grades; its possibilities for teaching children the common lessons of life, p. 101–2. 23. C. C. Coleman: Greek and Latin as aids to the study of English—a discussion, p. 102–3. 24. D. D. Hains: The theater of the Greeks, p. 103–5. 25. Lulu Williamson: Reading in the first and second grades, p. 105–7. 26. B. F. Moore: Reading in the third and fourth grades, p. 107–9. 27. Anna Boruff: Reading in the fifth and sixth grades, p. 109–10. Discussion, p. 110–11. 28. Blanche Merry: Reading in the seventh and eighth grades, p. 111–12. Discussion, p. 113. 29. H. W. Stopher: Music contests and their effects upon the schools, p. 113–14. 30. W. A. Millis, R. J. Aley: The county institute, p. 115–17. Discussion, p. 117–18.

133. **Iowa state teachers' association.** Proceedings of the fifty-fourth annual session, held at Des Moines, Iowa, December 28, 29, 30, and 31, 1908. Des Moines, Iowa, Emory H. English, state printer, 1909. 247 p. 8°.

Contains: 1. Abbie S. Abbott: The high school and the individual, p. 12–17. 2. Reports of the committee of the educational council: School boards, p. 17–29; Pensions and tenure of office of teachers, p. 30–34. 3. W. H. Norton: The American college and the democratic ideal, p. 46–50. 4. S. L. Chandler: Are college salaries adequate? p. 50–55. 5. G. W. Samson: The trend to one graduate degree, p. 56–60. 6. E. D. Starbuck: How shall we deepen the spiritual life of the college, p. 60–65. 7. F. F. Almy: The way out of the elective class—the group system, p. 65–70. 8. G. C. Fracker: The delinquent college student, p. 70–74. 9. Fannie Duren: Cooperation of teacher and librarian in establishing standards for the reading public, p. 74–80. 10. Elizabeth Bills: The teaching of English in the high schools of the West, p. 80–83. 11. R. B. Crone: Medical inspection, p. 97–104. 12. E. F. Schall: School sanitation and hygiene, p. 104–7. 13. F. T. Oldt: School architecture, p. 108–14. 14. Jessie E. Dicks: The relation of the primary to the kindergarten, p. 114–17. 15. W. D. Hanson: How far should the grammar grades prepare for the high school? p. 118–21. 16. O. W. Hunt: The relation of the grade teacher to the principal, p. 121–23. 17. J. R. Hanna: Literature in public school, p. 123–26. 18. J. B. Sullivan. The outsider's view of manual training and its relation to the social and commercial world, p. 126–33. 19. L. C. Bryan: Manual training from the superintendent's viewpoint, p. 140–45. 20. F. T. Tompkins: The future normal institute, p. 146–49. 21. L. C. Brown, F. D. Joseph: The need of more training schools for teachers and how such schools may be provided, p. 19–55, 156–58. 22. F. E. George: Fire protection in public schools, p. 158–62. 23. W. N. Clifford: Forestry and the schools, p. 162–65. 24. A. H. Avery: The superintendent's relation to the high school, p. 165–66. 25. G. E. Weaver: Penmanship in the grades, p. 167–70. 26. J. C. Howell: Penmanship in the high school, p. 170–75. 27. W. S. Hendrixson: The ends to be accomplished through the teaching of science in the secondary schools, p. 180–84. 28. S. L. Thomas: The corrective value of science in the high school, p. 184–86. 29. L. S. Ross: Should there be a place in the high-school course for bacteriology and elementary medicine? p. 186–91. 30. Frank Nagel: The value of music in the public schools, p. 191–95. 31. A. G. Smith: The value of physics as seen from the viewpoint of the college, p. 195–98. 32. J. F. Riggs: The next step in school legislation, p. 199–205.

134. **Iowa state teachers' association.** Proceedings of the fifty-fifth annual session, held at Des Moines, Iowa, November 4, 5, and 6, 1909. Des Moines, Emory H. English, state printer, 1910. 264 p. 8°. (O. E. Smith, secretary, Indianola, Iowa)

Contains: 1. E. J. H. Beard, president: Address, The rural schools, p. 38–45. 2. J. F. Riggs: The state association and school legislation, p. 45–52. 3. Pension and tenure of office of teachers, p. 55–59. 4. Report of the committee on medical inspection in schools, p. 59–76. 5. Report of committee on Master's degree, p. 77–79. 6. F. O. Norton: Are denominational colleges a necessary and permanent part of our educational system? p. 80–88. 7. A. B. Storms: The ethical by-product of higher education, p. 88–95. 8. W. H. Bender: The training of the high school teacher, p. 95–99. 9. C. V. Finlay: The place of the private school in secondary work, p. 99–103. 10. J. C. Nelson: The educational value of the vocational subjects, p. 103–6. 11. J. E. Marshall: School hygiene and sanitation, p. 107–10. 12. F. A. Nims: Ethics, morals, and religious principles in our public schools, p. 110–14. 13. L. G. Focht: The high school course of study, p. 114–16. 14. F. E. King: How to keep the boys in schools, p. 117–19. 15. C. H. Bailey: The educational significance of the arts and crafts movements, p. 120–24. 16. A. C. Newell: Should we aim at the vocational side or the aesthetic in teaching the manual arts? p. 125–27. 17. Fan B. Sanders: The relation of arts to crafts in our public schools, p. 127–30. 18. Dollie D. Burgess: Elementary bookkeeping—object, methods, and results, p. 130–33. 19. Alice M. Hunter: Office practice, p. 133–37. 20. W. R. Baker: Business English and correspondence, p. 137–42. 21. Winifred Cockrell: The application of kindergarten principles, p. 142–45. 22. Celeste Givens: The preservation and culture of the voice, p. 146–50. 23. J. P. Stephenson president college department round table: Address, p. 150–54. 24. H. G. Campbell: Are our colleges meeting their responsibility in respect to moral training? p. 154–61. 25. J. H. T. Main: What is a reasonable requirement for a five year state certificate? p. 161–64. 26. C. M. Miller: Rural school graduation—How successfully accomplished, p. 164–67. 27. W. F. Chevalier: Shall the school year be lengthened to ten months? p. 168–72. 28. J. H. Beveridge: The pensioning of Iowa teachers, p. 172–75. 29. Georgia Alexander: Language and literature in the primary grades, p. 175–84. 30. C. O. Denny: [Latin] Sight reading, p. 185–86. 31. The preparation of high school Latin teachers, p. 187–91. 32. Ellen G. Wing: Manual and domestic arts for girls, p. 191–95. 33. C. H. Brown: Art and manual training, p. 196–98. 34. S. M. Hall: Decoration of school rooms, p. 198–200. 35. The educational value of rhythm, p. 200–3. 36. W. A. Brandenburg: The place of physical education in our public school curriculum, p. 203–6. 37. G. W. Tidd: The advisability of the cultural course in physics, p. 206–7. 38. Etta M. Bardwell: Biology notebooks, p. 208–11. 39. Katherine H. Macy: The cultural value of bird study, p. 211–14. 40. R. B. Wylie: Botany in the Iowa high schools, p. 215–19. 41. E. C. Roberts: The place of geography in the high school, p. 219–21. 42. J. H. Lees: How teachers of physiography can use the Iowa geological survey, p. 221–22. 43. Commercial geography in the high school, p. 222–25. 44. C. P. Colgrove: Training in character building, p. 225–32.

135. **Kentucky educational association.** Proceedings of the thirty-eighth annual session. Estill Springs, Irvine, Ky., June 22–24, 1909. Frankfort, Ky., Frankfort printing co. [1909] 258 p. 8°. (T. W. Vinson, secretary, Frankfort, Ky.)

Contains: 1. Don Carlos Ellis: Forestry and schools, p. 28–36. 2. H. O. Sluss: To what extent shall we yield to the demand for industrial training in our schools? p. 36–42. 3. C. W. Mathews Should we teach agriculture in our elementary schools? p. 49–56. 4. R. H. Crossfield: What are colleges and universities doing for the moral welfare of their students? p. 71–81. 5. Mrs. F. O. Stout:

Physical education at state university, p. 118–26. 6. J. K. Patterson: The university and its relation to the public high school, p. 131–38. 7. F. F. Thwing: On teaching geometry [high school] p. 167–76. 8. G. M. Money: Enforced attendance for county schools, p. 208–12. 9. N. L. Taylor: The county board of education, p. 220–24.

136. **Louisiana. Conference of high school principals of public education.** Proceedings of the [first] conference, Baton Rouge, La., December 16, 17, and 18, 1908. Baton Rouge, The New advocate official journal, 1909. 142 p. 8°. (Joseph E. Blum, secretary)

137. **Louisiana. Conference of parish superintendents of public education.** Proceedings of the [twenty-first annual] conference, Baton Rouge, Louisiana, December 16, 17, and 18, 1908. Baton Rouge, The New advocate official journal, 1909. 127 p. 8°. (L. J. Alleman, secretary)

138. **Maryland state teachers' association.** [Proceedings of the] forty-second annual meeting, Mountain Lake Park, Md., June 29–July 2, 1909. n. p., 1909. 173 p. 8°. (H. W. Caldwell, secretary, Chesapeake City, Md.)

Contains: 1. Sarah E. Richmond, president: Address, p. 17–22. 2. Aggie J. Davis: Opening exercises, p. 23–25. 3. G. D. Strayer: [Problems of education and possibility of standards of efficiency in teaching] p. 25–32. 4. J. D. Worthington: The country teacher, p. 32–37. 5. Isobel Davidson: English in the primary schools—the teacher's preparation, p. 39–43. 6. Hanna A. Coale: The best ways for expression of ideas, p. 44–48. 7. Nan L. Mildren: Story-telling and the poem in language, p. 48–53. 8. Dandridge Murdaugh: [Reading lessons] p. 53–55. 9. J. M. Gambrill: Education—the old and the new, p. 64–73. 10. G. D. Strayer: [Nature and nurture in determining achievement of individual] p. 74–80. 11. W. H. Wilcox: English in the intermediate grades—the preparation of the teacher, p. 82–87. 12. Anne M. Luman: Composition work and its method, p. 87–90. 13. N. W. Cameron: Cultivation of the imagination, p. 90–95. 14. J. Rosier: Public education and social efficiency, p. 97–103. 15. W. T. Warburton: [Suggestions to teachers] p. 103–109. 16. J. T. White: Opening exercises, p. 110–12. 17. S. S. Handy: Purpose and aim in presentation—aims in literature, p. 112–14. 18. Maude Brown: My method in presenting the English classics, p. 115–19. 19. U. G. Palmer: The use and abuse of English grammar, p. 119–21. 20. Ida P. Stabler: Development of power in the use and appreciation of good English, p. 121–26. 21. Lelia N. McCoy: Use of the school library in teaching English, p. 126–28. 22. G. H. Lamar: Address, p. 131–37. 23. C. T. Wright: Minimum qualifications for first-class teacher's certificate, p. 146–53. 24. J. P. Fockler: The superintendent's visit, p. 155–59. 25. J. W. Thomas, chairman: Report of the committee on "Text books in history," p. 159–60. 26. Report of committee on physical training, p. 160–61.

139. **Massachusetts state teachers' association.** Papers read at sixty-fifth annual meeting, Worcester, November 26, 1909. Journal of education, 70: 568–71, December 2, 1909. (C. M. Grover, secretary, Boston, Mass.)

Contains: 1. A. S. Draper: The necessary groundwork of industrial training, p. 568–69. 2. J. G. Cannon: Commercial education, p. 569–70. 3. Curtis Guild, *jr.*: Materialism and education, p. 570. 4. John Golden: Industrial education from the standpoint of organized labor, p. 570–71. 5. E. G. Cooley: Shall we teach economics in our schools? p. 571.

140. **Michigan schoolmasters' club.** Journal, forty-fourth meeting held in Ann Arbor, March 31, April 1, 2, 3, 1909. Ann Arbor, Michigan, The Club [1909?] vi, 214 p. 4°. (Louis P. Jocelyn, secretary-treasurer, Ann Arbor, Mich.)

Contains: 1. F. A. Manny: The background of the certificate system, p. 3–8. 2. L. J. Wylie: The examining board and its functions, p. 8–19. 3. G. D. Strayer: The meaning of heredity in education, p. 19–29. 4. C. B. Davenport: In how far and in what way is it true that the child is bound by heredity? p. 29–33. 5. R. M. Wenley: What light does heredity throw upon the possible future of education? p. 33–52. 6. E. D. Kelly: Latin in the preparatory schools, p. 64–67. 7. Cecile Gauntlett: The aims and difficulties of beginning Latin, p. 67–69. 8. A. S. Hudson: Problems of the high school Latin course, p. 70–73. 9. C. H. Carrick: Physics, from the viewpoint of the superintendent, p. 74–76. 10. Loa Green: The relation of high school physics to other school studies, p. 76–79. 11. G. A. Miller: The future of mathematics, p. 87–93. 12. J. F. Thomas, Aleida J. Pieters: Some considerations on the report of the Committee of eight on the teaching of history, p. 93–94, 94–95. 13. Lucy Elliott: Applications in historical teaching to modern conditions—ancient history, p. 96–101. 14. Lulu B. Southmayd: Points of contact between English and American history, p. 101–5. 15. L. A. Chase: How far may legal and constitutional problems be emphasized in history teaching? p. 105–6. 16. F. L. Paxson: The legal basis of American history, p. 107–11. 17. Elsie Cooper: Constitutional history in the high school, p. 112–13. 18. N. A. Harvey: The influence of Darwinian doctrines upon the development of psychology, p. 113–18. 19. E. G.

Lancaster: The effect of the Darwinian doctrines on education, p. 118–23. 20. J. R. Bishop: Some observations upon commercial courses based on a recent visit to English schools, p. 130–38. 21. R. J. Bennett: The study and practice of accountancy, p. 138–46. 22. A. H. Holmes: Cultural value of commercial subjects, p. 146. 23. Gertrude O. Hunnicutt: Entrance requirements for business colleges, p. 147–54. 24. A. H. Holmes: The development of character, p. 155–59. 25. D. H. Springer: Should the university place commercial subjects upon the list of electives from which entrance credits may be chosen? p. 159–66. 26. J. E. Hammond: Business ethics as exemplified by teachers and proprietors, p. 166–72. 27. W. E. Gould: Is the elimination of geology from the high school course of study advisable? p. 178–81. 28. W. H. Hobbs: What should be taught in a year's high school course in physiography? p. 181–83. 29. F. W. Frostic: Some phases of field geography in the high school, p. 184–87. 30. L. D. Scott: The training of the teacher of physical geography, p. 188–89.

141. **Michigan state teachers' association.** Proceedings of the fifty-seventh annual meeting, held at Saginaw, October 28–30, 1909. Moderator-topics, 30: 167–69, 189–92, 211–14, 238–42, 261–66, 325–30, November 4, November 11, November 18, November 25, December 2, December 23, 1909. (John P. Everett, secretary, Ypsilanti, Mich.)

Contains: 1. W. H. French, president: Address, p. 189–91. 2. H. A. Miller: Current criticism of college methods and ideals, p. 212–14. 3. C. G. Wade: Shall the high school be extended downward to include the seventh and eighth grades? p. 238–39. 4. Josephine Goss: Grading and promotion of pupils, p. 240. Discussion, p. 240–41. 5. Edna Lyman: The purpose and results of telling stories to children and the gain to the children from different types of stories, p. 262–64. 6. Florence M. Hopkins: What the library can do for the high-school pupil, p. 264–66. 7. M. S. W. Jefferson: How geography may be made to help the work in history, p. 327–29. 8. Writing in primary grades, p. 329–30.

142. **Minnesota educational association.** Journal of proceedings and addresses of the forty-seventh annual convention, Minneapolis, Minn., October 28–30, 1909. Minneapolis. Minn., 1909. 276 p. 8°. (J. M. Guise, secretary, St. Paul, Minn.)

Contains: 1. W. C. Bagley: Modern education and moral development, p. 54–61. 2. G. A. Franklin: Do industrial courses promise substantial returns in efficiency? p. 63–66. 3. W. S. Jones: Manual training and domestic science; why they should have a place in the school curriculum, and the extent and purposes of the work, p. 140–42. 4. L. E. Covell: Should the free text-book system be adopted? p. 151–55.

143. **Mississippi teachers' association.** Proceedings of the twenty-fifth annual meeting, Meridian, April 28, 29, and 30, 1910. Jackson, Miss., Tucker printing house [1910] 196 p. 8°. (Edward L. Bailey, secretary, Jackson, Miss.)

Contains: 1. J. R. Ellis: President's address, p. 24–31. 2. J. N. Powers: Address, p. 34–39. 3. C. F. Capps: Present educational tendencies, p. 39–46. 4. S. C. Hall: Present educational tendencies, p. 46–48. 5. D. A. Hill: Right views of education, p. 48–51. 6. D. C. Langston: "The place of the manual and industrial arts in education," p. 51–54. 7. J. C. Jones: Physical training in public schools, p. 54–57. 8. J. M. Kennedy: Present day problems in education, p. 57–60. 9. R. H. Hester: A glance at the grammar grades, p. 60–63. 10. T. P. Scott: The two-fold function of the high school—preparation for college and for life, p. 64–70. 11. M. W. Schwartz: [The commercial course] p. 70–75. 12. R. P. Linfield: Should there and can there be a high school course of classical and vocational electives devised to meet present conditions in Mississippi? p. 76–84. 13. J. C. Windham: If such a course is possible, shall the schools or colleges devise it? p. 84–89. 14. G. H. Alford: The work of the National Government in extending agricultural education through the public schools, p. 89–92. 15. W. C. Sweat: The county superintendent in the schoolroom, p. 92–94. 16. G. L. Clothier: Some conservation problems for Mississippi, p. 95–98. 17. Andrew Allison: A laboratory course in physical geography, p. 98–105. 18. Anna L. Fant: The teacher as a nature student, p. 105–9. 19. R. C. Morris: The content of a high school course in botany, p. 109–14. 20. Kate Williams: What a primary teacher should know, p. 120–24. 21. Stella B. Redding: Literature in the primary grades, p. 124–29. 22. Margaret Graham: The problem of the primary teacher in the rural school, p. 130. 23. Winnie Welborne: Nature study: its relation to other subjects and how this relation may be maintained, p. 131–35. 24. Susie V. Powell: Report of Mississippi school improvement association 1909–10, p. 136–39. 25. F. L. Riley: Is state history worth while? p. 140–44. 26. M. W. Schwartz: Mississippi state classical association. The report of the president on the work of the year, p. 144–47. 27. A. L. Bondurant: Present conditions of Latin and Greek study in Mississippi, p. 147–58. 28. M. Latimer: What can be done to stimulate the study of Greek in our high schools? p. 159–61. 29. Margaret J. Warren: The translation: its value in the study of the classics, p. 161–64. 30. Josephine Fitts: Should Latin be taught in the agricultural high schools? p. 164–65.

144. **Missouri state teachers' association.** Proceedings and addresses, forty-eighth annual meeting, Saint Louis, Missouri, December 28, 29, 30, 1909. Fulton, Mo., The Gazette publishing co., 1910. 344 p. 8°. (E. M. Carter, secretary, Jefferson City, Mo.)

Contains: 1. B. G. Shackleford, president: Address, The faculty of effort as an end in education, p. 27–32. 2. O. Heller: Painful thoughts on painless education, p. 32–35. 3. W. Williams: For the life that now is, p. 36–39. 4. J. M. Greenwood: William Torrey Harris—educator, philosopher, and scholar, p. 39–53. 5. T. M. Johnson: Dr. William T. Harris, p. 53–54. 6. J. D. Elliff: Report on the enforcement of the compulsory attendance law, p. 54–58. 7. H. A. Gass: The country school—a vision of the future, p. 58–63. 8. H. L. Albert: The teacher and the public health, p. 63–71. 9. W. J. Hawkins: Readjustments in our school system, p. 72–79. 10. W. O. Allen: The function of the college in the training of teachers, p. 80–85. 11. L. B. Sipple: Qualifications of an eighth grade pupil, p. 87–93. 12. M. V. Bashore: The compulsory attendance law, its uses and abuses; what amendments should be made in it, and how to get them, p. 94–95. 13. B. Fox: How may we shorten the course of study for our rural schools? p. 95–98. 14. T. R. Luckett: The age of teachers, p. 98–100. 15. W. Colley: Should certificates be renewed when teachers fail to attend association and other teachers' meetings? p. 100–2. 16. H. E. Braschler: The rural school teacher, preparation and certification. Present conditions, p. 104–5. 17. C. H. McClure: Preparation and certification of teachers, p. 106–15. 18. J. D. Elliff: The rural school problem, p. 115–17. 19. G. H. Capps: Demand for agriculture in the high school, p. 117–19. 20. L. E. Brous: Agriculture in the high school. Demand for such a course, p. 119–21. 21. H. A. Phillips: Contents of a course of study in agriculture for the high school, p. 121–24. 22. L. Ellis: What the elementary school should accomplish in reading and literature, p. 126–29. 23. Elizabeth Bragg: What should we accomplish in language and grammar in the elementary grades? p. 129–31. 24. A. E. Martin: What the elementary schools should accomplish in arithmetic, p. 131–33. 25. J. L. Meriam: Play as a motive for school work, p. 138–42. 26. W. L. Barrett: The summer play school, p. 142–47. 27. M. Burrows: Commercial education in the high school, p. 147–51. 28. Ellen B. Atwater: What topics in ancient and mediæval history need special emphasis to prepare the pupil for the modern period? p. 153–58. 29. Grace Graves: Geographic influence in American history, p. 158–61. 30. S. A. Baker: The future citizen and civics instructions in the high schools, p. 163–65. 31. J. F. Garber: The use of the green house in botany laboratory work, p. 166–69. 32. B. M. Stigall: The status of nature study in our system of education, p. 169–73. 33. A. S. Langsdorf: Some tendencies in engineering education, p. 173–77. 34. O. E. Winebrenner: Chemistry, of what use is it? p. 187–89. 35. Lindley Pyle: The use of the graph and graphical methods in the teaching of physics, p. 190–91. 36. M. J. Patterson: Arithmetic in the grades, p. 192–98. 37. W. A. Luby: Comparison of arithmetic with algebra and geometry, p. 198–204. 38. B. Cosby: Some real problems in arithmetic, p. 204–9. 39. R. A. Wells: The use of equation in elementary arithmetic, p. 209–13. 40. H. F. Pratt: The teaching of commercial arithmetic in the high school, p. 213–19. 41. G. Melcher: The value of the history of arithmetic, p. 219–27. 42. D. E. Riggs: Psychology of music, p. 228–33. 43. Lena M. Spoor: The true mission of public school music, p. 233–35. 44. Teresa Finn: The correlation of public school music with the after study of music, p. 236–37. 45. W. L. Eastwood: The place of the vocational school in a rational scheme of education, p. 238–40. 46. Alberta G. Murphy: School room decoration, p. 240–44. 47. Stella C. Harris: Some problems of the present in industrial work, p. 244–47. 48. W. H. Funk: Manual training in the grades, p. 247–49. 49. J. B. Game: Training and equipment of the high school teacher of Latin, p. 250–54. 50. Laura Yeater: The race problem in Cæsar, p. 254–59. 51. M. M. Hart: The acquisition of power in classics, p. 259–65. 52. Eva Johnston: Introduction of the Menæchmi of Plautus, p. 265–67. 53. F. H. Barbee: Direction of outside reading in English, p. 274–79. 54. L. W. Rader: The elementary school course in English, p. 280–88. 55. W. Hanssler: What modern German literature is adapted for secondary schools? 1. For thorough classroom reading. 2. For collateral and rapid reading courses, p. 288–93. 56. J. H. Beckman: How can this society best perform its mission toward improving the instruction in German in Missouri? p. 293–97. 57. G. Douay: The preparation of students in French for entrance to college, p. 297–302. 58. J. A. Vaeth: The teaching of French, p. 302–7. 59. Julia Krug: Short cuts to a knowledge of the best books for children, p. 309–13. 60. Laura Doolittle: The use of the library in teaching history in the elementary school, p. 313–15

145. **New Jersey state teachers' association.** Annual report and proceedings of the 55th annual meeting, held in the public high school, Atlantic City, N. J., December 28, 29, and 30, 1909. [Trenton, N. J., Beers & Frey, 1910] 246 p. 8°. (Charles B. Boyer, secretary, Atlantic City, N. J.)

Contains: 1. C. J. Baxter: Industrial education, p. 18–20. 2. E. R. Johnstone: "What shall we do with the backward child?" p. 21–24. 3. J. M. Green: Our educational system, its cost and its return, p. 25–31. 4. Woodrow Wilson: "The state and the citizen's relation to it," p. 32–42. 5. Mrs. W. I. Thomas: The juvenile delinquent and the schools, p. 43–51. 6. L. S. Davis: The trend of the teens, p. 52–59. 7. J. F. Fort: New Jersey and its schools, p. 60–68. 8. E. A. Alderman: The educational achievement of a generation, p. 69-80. 9. J. W. Carr: Character development through the agency of the public schools, p. 81-89. 10. Naomi Norsworthy: Teaching children to study (an abstract), p. 98-101. 11. F. A. Parsons: The call of the arts and crafts and our response (an abstract), p. 102-4. 12. President's address, p. 217-41.

146. **New York (State) Associated academic principals.** Proceedings of the twenty-fourth annual meeting, at Syracuse, N. Y., December 28-30, 1908. Albany, University of the State of New York, 1909. 114 p. 8°. (Education department bulletin, no. 458) (E. P. Smith, secretary, 1911, North Tonawanda, N. Y.)

Contains: 1. F. E. Wade: Probation as a means of overcoming truancy, p. 7-17. 2. E. L. Stevens: How shall local industries be recruited? p. 19-32. Discussion, p. 32-38. 3. G. P. Bristol: Foreign languages in the high school, p. 39-46. Discussion, p. 46-52. 4. A. R. Brubacher: The high school principal, p. 52-59. 5. C. F. Wheelock: Educational developments under the syllabus of 1905, p. 60-68. 6. W. H. Crawshaw: Poetry and social progress, p. 69-82. 7. S. S. Travis: High school fraternities, p. 83-91. Discussion, p. 91-95. 8. E. L. Mead, chairman: Report of committee on athletics, p. 96-98. 9. C. L. Mosher, chairman: Report of committee on present courses of study, p. 98-100.

147. **New York state association of school commissioners and superintendents.** Proceedings of the fifth-fourth annual meeting, at Rochester, N. Y., November 22-24, 1909. Albany, University of the state of New York, 1910. 72 p. 8°. (Education department bulletin, no. 472) (Jane Haring, secretary, 1910-11)

Contains: 1. T. D. Wood: Rural school sanitation, p. 6-13. 2. D. D. T. Marshall: What constitutes efficient supervision? p. 14-17. 3. W. T. Clark: Report of committee on rural school problems, p. 19-20. Discussion, p. 20-29. 4. F. M. Godfrey: Agriculture and nature study, p. 32-35, 36. 5. J. V. Sturges: The library, p. 37-47. 6. J. S. Cooley, M. B. Mann: Some phases of school sanitation, p. 56-60, 60-65.

148. **New York state science teachers' association.** Proceedings of the thirteenth annual meeting, held at Syracuse university, Syracuse, N. Y., December 29-30, 1908. Albany, University of the State of New York, 1909. 138 p. 8° (Education department bulletin, no. 459) (L. I. Hawkins, president, 1911, Cortland, N. Y.)

Contains: 1. G. F. Warren: High school agriculture, p. 21-28. 2. L. S. Hawkins, Augustus Klock: Science for elementary schools, p. 30-34, 34-38. 3. H. A. Carpenter: Ionization theory, p. 42-51. 4. W. G. Levison: A method and apparatus for detecting and exhibiting the fluorescence of fluorescent substances, p. 52-54. 5. I. D. Scott: A demonstration of a map and modeling apparatus, p. 59-61. 6. R. L. Fernbach: The chemist versus the trained workman, p. 65-70. 7. Charles Forbes: Demonstration of physical apparatus, p. 71-76. 8. William Timbre: Some practical physics apparatus, p. 77-88. 9. B. O. Burgin: Demonstration of dynamo and motor, p. 90-92. 10. S. B. Everts: Plain cross section drawings on cardboard for school use, p. 95-99. 11. A. G. Clements: Why are the ideals of biology teaching not realized? p. 100-3. 12. C. G. Rogers: The present and future of physiology in the high school, p. 104-14. 13. H. M. Smith: Recent progress in artificial illumination, p. 115-30.

149. **New York state teachers' association.** Proceedings of the sixty-third annual meeting, held at Syracuse, N. Y., December 28-30, 1908. Albany, University of the State of New York, 1909. 414 p. 8°. (Education department bulletin, no. 457) (Richard A. Searing, secretary, North Tonawanda, N. Y.)

Contains: 1. S. S. Wise: Teacher and child, p. 7-19. 2. J. P. O'Hern, president: The teacher of English, p. 38-52. 3. Matilda T. Karnes: The dramatic instinct an aid in composition writing, p. 53-64. 4. F. T. Scott: The preparatory fallacy, p. 65-74. 5. C. E. Jones: Proposed changes in the syllabus, p. 75-79. 6. E. D. Holmes, chairman: Report of the committee on the work of teachers of English in high schools, p. 80-82. 7. Margaret K. Smith: The psychological aspect of training backward children, p. 85-94. 8. E. R. Johnstone: The social side of the question of special class children, p. 95-98. 9. Sophie C. Becker: The training of defective children from a principal's standpoint, p. 99-114. 10. A. W. Edson: Training of backward children, p. 114-15. 11. Grace L. Cook: The training of teachers in Great Britain, p. 117-23. 12. F. J. Cheney: Our normal schools, p. 124-35. 13. David Gibbs: The normal training school, p. 136-46. 14. Harriet E. Stevens: Primary reading, p. 147-53. 15. Edith M. Tufts: The place and value of the rhyme in beginning reading: how should the various methods be coordinated? p. 154–56. 16. F. H. Collins: Essentials of instruction in drawing for elementary schools, p. 168–74. 17. R. K. Piez: Perspective: the grammar of pictorial drawing, p. 175–77. 18. A. D. Dean: The relation of the manual arts in elementary and secondary schools to the movement for industrial education, p. 178–82. 19. Schuyler Bull: Lettering, p. 183–84. 20. Bonnie E. Snow: Round table discussion on art and drawing instruction in the primary grades, p. 185–87. 21. F. E. Welles: An inductive method of teaching Cæsar, p. 191–95. 22. J. P. Behm: Cæsar through the eyes of Cicero, p. 197–203. 23. J. R. Fairgrieve: Greek in the high school, p. 207–11. Discussion, p. 211–12. 24. J. I. Bennett: Greek in the colleges, p. 213–15. Discussion, p. 215–17. 25. C. C. Macgregory: The place of drawing and the mechanic arts in a commercial course, p. 219–27. 26. A. J. Scarborough: Business correspondence—getting results, p. 229–33. 27. G. M. Forbes: The general problem of extending the educational system to prepare for industrial pursuits, p. 240–41. Discussion, p. 241–43. 28. W. Noyes: The definite contribution which manual arts and drawing may make toward industrial efficiency, p. 244–46. Discussion, p. 247–51. 29. J. E. Sweet: Trade schools: their place in the public school system, p. 252–54. Discussion, p. 254–56. 30. Sherman Williams: With what purpose in view should history be taught? p. 257–62. 31. S. D. Arms: In the teaching of civics, on what phase or phases of it should the chief emphasis be laid? p. 263–66. 32. P. S. Maguire: What should be the course in history for graduation from high schools? What history ought to be demanded by colleges in their requirements for admission? p. 267–73. 33. E. W. Ames: Purpose of an examination in history, p. 274–77. 34. Nature study discussion, p. 278–79. 35. H. N. Parsons: Library books best adapted for pupils of the various grades, p. 284–91. 36. J. E. Banta: Use of the dictionary in the grades, p. 292–93. 37. W. C. Kruse: The reading of library books, p. 294–95. 38. C. W. Blessing: What changes or omissions should be made in the library books or in the selections for memorizing given for the various grades in the New York State syllabus? p. 296–303. Discussion, p. 303–6. 39. A. W. Edson: Group teaching in elementary grades, p. 307–11. 40. A. C. Thompson: Ways and means of emphasizing vital points in the essential subjects in elementary schools, p. 312–16. Discussion, p. 316–18. 41. Georgia Alexander: How may instruction in spelling be made more effective? p. 319–28. 42. H. P. Emerson: English schools, p. 329–35. 43. C. E. White: My visit to English schools, p. 336–43. 44. L. F. Hanmer: The relation of athletics to the school, p. 344–51. 45. F. H. Dimick: Elementary schools athletic league, p. 352–56. 46. E. J. Ward: The conduct and benefits of playgrounds, p. 357–62. 47. Jessie H. Bancroft: The place of games and folk dances in the school curriculum, p. 363–68. 48. What changes are desirable in the New York State elementary syllabus? Discussion, p. 368–69.

150. **New York (State) University. University convocation.** Proceedings of the forty-seventh annual convocation, October 28–30, 1909. Albany, University of the state of New York, 1909. 126 p. 8°. (Education department. Bulletin no. 460)

Contains: 1. LeB. R. Briggs: The American college and the American university, p. 10–26. 2. W. D. Johnston: The library as a reinforcement of the school, p. 27–32. Discussion by Ida M. Mendenhall and Mary E. Hall, p. 33–42. 3. J. M. Green: Teaching as an occupation for men, influences adverse and favorable, p. 43–51. 4. A. S. Draper: The relative educational standing of New York state, p. 59–74. 5. J. M. Thomas: Moral instruction in high schools and colleges, p. 75–85. 6. Rush Rhees: Applied science and liberal culture, p. 86–94. 7. Julius Sachs: Improved standards in teaching Latin, p. 95–106. 8. R. C. S. Drummond: The organization and direction of athletic sports in secondary schools, p. 114–23.

151. **North Carolina association of city public school superintendents and principals.** Proceedings and addresses of the twenty-fifth annual session, Durham, N. C., January 27–29, 1910. Raleigh, N. C., Edwards & Broughton printing company, 1910. 95 p. 8°. (A. T. Allen, secretary, 1911, Salisbury, N. C.)

Contains: 1. W. R. Mills: School reports and school efficiency, p. 8–13. 2. W. D. Carmichael: Report of the Committee on economy in the course of study, p. 18–48. 3. J. A. Bivins: How to make the teachers' meeting more effective, p. 52–61. 4. R. J. Tighe: Teaching children how to study, p. 62–73. 5. E. C. Brooks: A comparison of school systems, p. 74–94.

152. **North Carolina teachers' assembly.** Proceedings and addresses of the twenty-fifth annual session, held at Charlotte, N. C., June 16–19, 1908. Raleigh, N. C., Presses of Edwards & Broughton printing co., 1909. 343 p. 8°.

Contains: 1. P. P. Claxton: The school and the state, p. 58–85. 2. S. A. Knapp: What can the teacher do for the improvement of rural conditions? p. 116–30. 3. O. T. Corson: The superintendent and the board of education, p. 229–35. 4. C. L. Coon: Science in the schools, p. 249–54. 5. Mrs. C. D. McIver: History of the woman's association for the betterment of public schoolhouses and grounds in North Carolina, p. 318–26.

153. **North Carolina teachers' assembly.** Proceedings and addresses of the twenty-sixth annual session, Morehead City, N. C., June 15–18, 1909. Raleigh, Presses of Edwards & Broughton printing company, 1909. 233 p. 8°. (R. D. W. Connor, secretary-treasurer)

Contains: 1. D. H. Hill: Opening address, p. 14–21. 2. T. R. Foust: President's annual address, p. 21–30. 3. E. K. Graham: The teacher and modern democracy, p. 30–43. 4. Mrs. C. D. McIver: The woman's association for the betterment of public schoolhouses and grounds, p. 43–48. 5. W. P. Few: Constructive educational leadership, p. 49–59. 6. C. L. Coon: Report of assembly committee on the history of education for 1908–1909, p. 69–75. 7. F. P. Hobgood: Report of committee on professional ethics, p. 76–83. 8. R. J. Tighe: Report of committee on teachers' salaries, p. 84–102. 9. J. Y. Joyner: Report of committee on course of study, p. 102–3. 10. Ellen H. Richards: How may the school influence the home? p. 103–11. 11. J. H. Highsmith: Directions and suggestions for child study, p. 112–19. 12. Anne Wetmore: Directions and suggestions for child study, p. 119–32. 13. Mary O. Graham: Child study as an aid in discipline, p. 132–42. 14. Mrs. I. T. Turlington: Child study as an aid in discipline, p. 142–54. 15. Mary K. Applewhite: Child study as an aid in instruction, p. 154–58. 16. Mrs. A. C. Gareissen: Child study as an aid to instruction, p. 158–71. 17. W. A. Graham: Science in the grammar school, p. 172–78. 18. Z. V. Judd: Science in the rural elementary school, p. 178–89. 19. H. L. Smith: Science in the high schools, p. 189–95. 20. A. C. Reynolds: The teachers' meeting, p. 196–202. 21. J. A. Bivins: The teachers' institute, p. 202–14. 22. M. C. S. Noble: The teachers' institute, p. 214–17. 23. E. C. Brooks: Home study for teachers, p. 217–24.

154. **North Dakota educational association.** Proceedings of the twenty-second annual session, held at Valley City, December 30 and 31, 1908, and January 1, 1909. Bismarck, N. D., Tribune, state printers and binders, 1909. 367 p. 8°.

Contains: 1. J. M. Gillette: Education for social efficiency, p. 57–63. 2. F. M. Sherarts: High school constants and college entrance requirements, p. 81–88. 3. H. S. Buffum: Concept of vocational education and methods of realization, p. 105–10. 4. C. C. Gray: Our attitude toward vocational training in the high school, p. 169–78. 5. E. M. Sherry: The desirability of instruction in the elements of agriculture in schools for rural communities, p. 228–39. 6. C. M. Beitler: How can high school algebra be made attractive to pupils, p. 261–62.

155. ——— Proceedings of the twenty-third annual session, held at Minot, December 28 to 31, 1909. Bismarck, N. D., Tribune, state printers and binders, 1910. 375 p. 8°. (C. R. Travis, secretary, Mayville, N. D.)

Contains: 1. A. P. Hollis, president: Address, p. 33–37. 2. W. L. Stockwell: The educational outlook in North Dakota, p. 38–42. 3. F. L. McVey: Recent educational tendencies, p. 43–47. 4. Report of committee of seven on adjustment of educational work in North Dakota with reference to the needs of the times, p. 48–105; L. G. Watson, G. F. Forster: Discussion of report of committee of seven, p. 105–7, 108–11. 5. Charlton Andrews: The influence of a higher institution of learning on the town in which it is located, p. 111–14. 6. M. A. Brannon: The influence of higher institutions of learning on a group of towns, p. 115–19. 7. A. D. Weeks: Ways in which the higher institutions may serve rural communities, p. 120–23. 8. W. M. Kern: How the school may influence industrial life, p. 123–28. 9. E. M. Sherry: Extension of school into life; the teacher's special preparation for this, p. 128–30. 10. Minnie J. Nielson: Extending "life" into the rural schools, p. 131–34. 11. G. A. McFarland: Means of extending the influence of higher educational instruction into life, p. 138–42. 12. Wallace Stearns: The lecture as a means of extending the influence of the higher educational institutions into life, p. 143–44. 13. J. H. Shepperd: Farmers' and teachers' institutes, p. 145–47. 14. G. F. Ruediger: Bulletins and school publications, p. 148–50. 15. J. M. Gillette: Extension of the influence of the higher institutions of learning by correspondence, p. 151–55. 16. C. C. Creegan: Means of extending the influence of the higher educational institutions into life for the improvement of citizenship, p. 156–61. 17. Joseph Kennedy: The means of extending the influence of the higher educational institutions for the improvement of the rural school, p. 162–67. 18. E. R. Edwards: Some current problems of secondary education, p. 173–77. 19. Nelson Sauvain: Value of elementary and secondary education compared with present cost, p. 177–81. 20. P. T. McNally: The Mandan plan of classification, p. 182–84. 21. L. P. Linn: The province of the high school in the preparation for life, p. 185–89. 22. P. A. McMillan: Are our schools meeting the real needs of the young people of North Dakota, p. 190–96. 23. F. Thordardson: The tobacco habit among pupils: is there a remedy? p. 197–201. 24. P. S. Berg: The relative value of high school studies—how shall they be determined? p. 202–11. 25. Dorothy M. Poppy: Proper relation of high school teachers toward high school social functions, p. 212–15. 26. H. L. Rockwood: The high school and physical education, p. 216–19. 27. B. A. Dunbar: Our athletic league—can it be made more practicable? p. 220–24. 28. H. A. Curran: How to judge text books in history and English, p. 225–28. 29. B. A. Wallace: Five problems of the teacher in teaching, p. 229–35. 30. Eula F. Miller: Construction and seat work, p. 238–40. 31. C. C. Gray: The teaching of geography not all text-book work, p. 241–53. 32. F. R. Barnes: How to correct the present defects in the rural school, p. 259–66. 33. Dalton McDonald: How to create the proper school spirit among the patrons of rural schools, p. 267–70. 34. B. O. Skrivseth: The need of special training for rural school teachers, p. 271–74. 35. B. A. Wallace: The course of study for rural schools, p. 275–81. 36. F. M. Wanner: Better supervision of the rural schools—in what does proper supervision consist, p. 282–83. 37. E. C. Hilborn: Improvement of school grounds, p. 286–91. 38. H. L. Bolley: Observation and teaching, p. 299–303. 39. M. N. Pope: The correlation of the physical geography with the political and commercial phases of the subject, p. 304–7. 40. G. F. Forster: The teaching of agriculture, p. 308–11. 41. G. R. Davies: School mathematics applied to the environment of the pupil, p. 312–19. 42. J. S. French: How may we give sciences their true cultural value in the class room, p. 320–22. 43. M. A. Brannon: What botany should be taught in the first year of plant study, p. 323–26. 44. H. L. Rockwood: Our prospects, p. 330–32. 45. H. C. Fish: High school museums and what can be done with them, p. 333–36. 46. Miss L. H. Bruhn: History—how to make it interesting to those who do not like it, p. 337–40. 47. Lillian G. Hall: How the teaching of history, civics, and social science may be made more efficient in the rural schools, p. 341–42. 48. Phoebe L. Minsart: How the teaching of history, civics, and social science can be made more efficient in the grades, p. 343–46. 49. W. A. Godward: History and civics in the high school, p. 347–49. 50. R. M. Black: How can we make the teaching of history, civics, and the social sciences more efficient in the teachers' training school, p. 350–53. 51. W. N. Stearns: On the teaching of history in the university, p. 354–56. 52. W. B. Thomas: Summary and plans for cooperation in history, p. 357–63. 53. Fanny C. Amidon: How to teach music in the high school, p. 368–70. 54. Clara B. Aldahl: How to interest boys in music throughout the eighth grade and high school, p. 371–73.

156. **Ohio college association.** *See* 800.

157. **Ohio state teachers' association.** [Proceedings of the] sixtieth annual session, June 29–July 1, 1909. Ohio educational monthly, 58: 331–403, July 1909.

Contains: 1. J. A. Shawan, president: The educational outlook, p. 331–36. 2. J. M. H. Fredrich: Appropriate education with reference to sex during the adolescent period, p. 336–37. Discussion, p. 337–42. 3. C. B. Galbreath: The library movement in Ohio, p. 343–48. 4. W. H. Elson: The measurement of efficiency and progress in school work, p. 348–52. 5. Dan Milliken: The gifted simpleton, p. 352–61. 6. F. B. Dyer: Intelligent cooperation between home and school, p. 361–68. 7. H. V. Hotchkiss: The ethics of the teacher, p. 376–83. 8. Josiah Strong: The times in which we live, p. 383–87. 9. E. A. Jones: Remarks as retiring commissioner, p. 387–89. 10. J. W. Zeller: The needs of our public schools, p. 389–93. 11. Herbert Welch: The socialization of the school, p. 393–97.

158. ——— [Proceedings of the] sixty-first annual session, June 28–30, 1910. Ohio educational monthly, 59 : [309]–398, July 1910.

Contains: 1. F. B. Dyer, president: Address, Teaching as a profession, p. 309–17. 2. E. A. Jones: A state-wide pension system, p. 317–24. 3. E. F. Moulton: Report of the legislative committee, p. 324–27. 4. H. C. Muckley: The physical care of school children, p. 327–33. 5. N. D. O. Wilson: Discussion, p. 333–35. 6. J. D. Simkins: Compulsory school laws, p. 335–41. 7. W. T. Magruder: The possibilities of industrial education, p. 341–48. 8. E. A. Hotchkiss: The problem of industrial education in small cities, p. 348–53. 9. J. W. Zeller: The problem of industrial education in the rural schools, p. 353–57. 10. G. C. Dietrich: Discussion, p. 357–60. 11. W. O. Thompson: Memorial address, p. 371–76. 12. J. V. McMillen: Confessions of a superintendent, p. 376–81. 13. F. B. Pearson: Confessions of a secondary teacher, p. 381–83. 14. Lillie A. Faris: Confessions of an elementary teacher, p. 383–86. Discussion, p. 386–93.

159. **Pennsylvania state educational association.** Proceedings of the fifty-third annual convention, held in Bethlehem, June 29 and 30 and July 1, 1909. Reprinted from the Pennsylvania school journal. 58 p. 8°. (J. P. McCaskey, secretary, Lancaster, Pa.)

Contains: 1. C. S. Foos: Pressing problems of state organization, p. 5–13. 2. W. H. P. Faunce: Pressing problems in education, p. 14–17. 3. J. C. Wagner, T. S. March, A. L. Jones, Joseph Howerth: Pressing problems in the borough schools, p. 18–20, 20–21, 21–23, 23–24. 4. J. P. McCaskey: The ever-pressing problem is the building of character, p. 24–25. 5. J. G. Becht, E. L. Kemp, A. T. Smith, A. C. Rothermel: Pressing problems in the normal schools, p. 26–28, 28, 28–30, 30–31. 6. E. D. Warfield, J. A. W. Hass, G. L. Omwake: Pressing problems in the colleges, p. 32, 32–33, 33. 7. S. S. Wise: Teacher and child, p. 33–39. 8. H. S. Putnam, T. S. Davis, W. W. Evans, and others: Pressing problems in rural schools, p. 39–42. 9. H. C. Missimer, J. J. Palmer, G. E. Reed: Pressing problems in the city schools, p. 42–46, 46–47, 47.

159*a*. **Pennsylvania state educational association.** Department conferences at Bethlehem . . . June 29 and 30 and July 1, 1909. Reprinted from the Pennsylvania school journal. 53 p. 8°.

Contains: 1. W. C. McClellan, F. L. Homer, G. W. Gerwig: High school course in English in relation to entrance requirements and best interests of student, p. 1–6, 6–8, 8–9. 2. W. B. Owen, I. C. M. Ellenberger, T. L. Brooks: High school training and its bearing upon civic integrity, p. 9–11, 11–12, 12–13. 3. W. S. Franklin: Work and play in education, p. 13–23. 4. G. M. Jones: Eyes that see not, p. 23–26. 5. Alice N. Parker: Pressing problems in the kindergarten, p. 27–30. 6. Henry Pease: The needs of the kindergarten, p. 30–31. 7. O. H. Bakeless: Economic worth of child study, p. 31–37. 8. J. L. Eisenberg, Percy Hughes: Pedagogical significance of instincts of the child, p. 37–39, 39–40. 9. Zettan Gordon: The special school for defective children, p. 40–43. 10. C. E. Karlson, B. M. Le Suer: Pressing problems in manual training, p. 44–45, 45–46. 11. C. A. Herrick, R. L. Johnson: Present condition of manual training and trade education, p. 46, 47–49. 12. F. E. Pray: Present status of industrial education, p. 49–51. 13. Iris Prouty: The present status of manual training and industrial education, p. 51–52. 14. W. L. Sayre: Manual training means mental training, p. 52–53.

159*b*. ——— **City and borough superintendents' department.** Proceedings of nineteenth annual session, Harrisburg, February 6, 7, and 8, 1909. Reprinted from the Pennsylvania school journal. 42 p. 8°.

Contains: 1. F. W. Robins, president: Address—Revision of elementary course of study, p. 1–4. 2. T. S. March: Revision of course of study, p. 4–6. 3. A. D. Yocum: State uniformity with elasticity in courses of study, p. 7–12. 4. Alvin Davison: Medical inspection of schools, p. 13–17. 5. H. J. Wightman: Improvement of the teaching force by salary schedules, p. 19–21. 6. W. A. Wilson: The improvement of the teacher by other means, p. 26–28. 7. R. L. Burns: Schools as community centers, p. 32–34. 8. J. L. Stewart: Development of the social conscience, p. 37–38. Discussions follow each topic.

159*c*. ——— ——— Proceedings of twentieth annual session, Harrisburg, February 8 and 9, 1910. Pennsylvania school journal, 58 : 471–524, May 1910.

Contains: 1. Grant Norris, president, and C. J. Scott: Educational trends, p. 471–75, 475–78. 2. L. P. Ayres: Relation of physical defects to school progress, p. 478–80. 3. J. W. Anthony, C. F. Hoban: Compulsory education in Pennsylvania, p. 481–88, 489. 4. M. E. Bennett: How to create writing ability, p. 490–91. 5. L. P. Ayres: Retardation: its significance and cure, p. 492–94. 6. L. H. Gulick: How to apply what we know about health, p. 495–500. 7. Samuel Hamilton: A plea for industrial education, p. 500–10. 8. H. C. Missimer, J. M. Coughlin: Industrial education, p. 510, 510–11. 9. L. H. Gulick: How the backward child is putting education among the sciences, p. 512–17. 10. O. P. Cornman: Backward children investigation in Philadelphia public schools, p. 518–21.

159*d*. ——— **County superintendents' department.** Proceedings of sixth annual session, Harrisburg, February 3 and 4, 1909. Reprinted from the Pennsylvania school journal. 40 p. 8°.

Contains: 1. G. A. Grim: The school board—five or more members—when take office—how selected? p. 1–2. 2. J. H. Hoffman: A revision of the school curriculum. What eliminate for thoroughness?—What add to make more practical? p. 2–4. 3. G. M. Philips: The new school code (questions and answers), p. 5–6. 4. J. H. Landis: How the school can best aid the home in its functions, p. 6–9. 5. E. M. Rapp: Vocational possibilities in country schools, p. 10–15. 6. Earl Barnes: Character building, p. 15–20. 7. G. B. Milnor: More effective school supervision, p. 20–23. 8. B. S. Boyle: How to make superintendents' visits most helpful? p. 23–26. 9. H. M. Roth: What a superintendent may do with added power and time, p. 26–27. Discussion, p. 27–30. 10. W. W. Evans: An elastic uniform course of study, p. 30–32. 11. N. C. Schaeffer: The new school code, p. 34–37. 12. Samuel Hamilton: Undue haste in education, p. 37–40.

159*e*. ——— ——— Proceedings of seventh annual session, Harrisburg, February 8 and 9, 1910. Pennsylvania school journal, 58 : 425–52, April 1910.

Contains: 1. I. H. Russell: How to improve certification of teachers, p. 425–28. 2. L. E. Smith: What change or improvement can be made in salary, p. 428–29. Discussion, p. 429–34. 3. J. W. Sweeney: Preparation for supervision, p. 434–37. 4. R. C. Shaw: Closer supervision, p. 437–40. 5. D. A. Kline: Medical inspection, p. 441–43. 6. J. K. Green: Waste in our schools, p. 443–47. 7. N. C. Schaeffer: Our problems, p. 449–50. 8. M. G. Brumbaugh: Philanthropy and public education, p. 450–52.

159*f*. **Pennsylvania state educational association. Directors' department.** Proceedings of fourteenth annual session, Harrisburg, February 4 and 5, 1909. Reprinted from the Pennsylvania school journal. 30 p. 8°.

Contains: 1. E. T. Furguson: Closer supervision of rural schools, p. 3-5. 2. H. B. Eastburn: The school code on closer supervision, p. 5-7. 3. H. W. Schick, president: Address, p. 7-9. 4. M. P. Wilson: Commercial museum collections, p. 9-10. 5. N. C. Schaeffer: Retardation in the grades and the new code, p. 10-13. 6. J. L. King: How a director may make the schools more efficient, p. 13-15. 7. H. M. Lessig, chairman: Report of the legislative committee, p. 17-18. Discussion, p. 18-21. 8. Samuel Hamilton: Individual efficiency, p. 21-24. 9. W. L. Phillips: A modern school, p. 24-28. 10. J. B. Small: Grounding in the fundamentals, p. 28.

159*g*. ——— ——— Proceedings of fifteenth annual session, Harrisburg, February 10 and 11, 1910. Pennsylvania school journal, 58: 379-415, March 1910.

Contains: 1. A. J. Simons: Condition of our rural schools, p. 380-83. 2. H. T. Hauer: Building the school house, p. 383-88. 3. J. A. Steese, R. S. Murphy: What the director may try to do for the schools, p. 388-89, 389-93. 4. N. C. Schaeffer: Failure of directors to maintain proper schools, p. 393-94. 5. W. F. Eberle: Manual training, p. 394-98. 6. J. D. Walker: A few changes in city schools, p. 398-99. 7. M. G. Brumbaugh: Problems of origin, destiny and duty, p. 402-3. 8. Samuel Hamilton: Hills, p. 404-9. 9. R. B. Tietrick: The conservation of real wealth, p. 410-13.

159*h*. ——— **High school department.** Proceedings of fourth annual session, Harrisburg, Pa., December 28, 29 and 30, 1908. Reprinted from the Pennsylvania school journal. 40 p. 8°.

Contains: 1. W. S. Steele: Secret fraternities in high schools, p. 1-3. 2. G. D. Robb: Special classes for backward pupils, p. 3. 3. P. M. Bullard: Preventing loss of first-year pupils, p. 3-4. 4. J. W. Moyer: How we manage our athletics, p. 4-5. 5. J. W. Moyer: The northeast forestry club, p. 5. 6. A. E. Kraybill: Home study of high school pupils, p. 5-6. 7. J. E. Wagner: Special work in agriculture in the high school, p. 6-10. 8. Irene E. McDermott: Household economy in the high school, p. 10-12. 9. W. S. Hertzog, C. D. Koch: Special work in the general high school, p. 12-13, 13. 10. A. D. Yocum: Training of high school teachers: a plea for colleges of education, p. 13-17. 11. O. H. Bakeless: The preparation and improvement of the high school teacher, p. 18-21. 12. L. E. McGinnes: Competent high school teachers, p. 21-23. 13. C. F. Hodge: Civic biology: a high school science devoted to community welfare and the national life, p. 24-30. 14. T. J. George: What are the reasonable requirements for admission to the high school? How shall these be enforced? p. 30-32. 15. F. E. Downes: What are the reasonable requirements? p. 32-34. 16. E. W. Little: The constants that all the colleges may reasonably exact for admission: how to be agreed upon and how enforced, p. 34-36. Discussion, p. 36-37. 17. E. W. Little, chairman: Report of the special committee of the National education association on the six year course of study, p. 38-39.

159*i*. ——— ——— Proceedings of fifth annual session, Harrisburg, Pa., December 28, 29 and 30, 1909. Pennsylvania school journal, 58: 333-73, February 1910.

Contains: 1. J. L. Eisenberg, R. P. Gleason: How can the high school serve and reach the entire public? p. 333-35, 335-36. 2. Sarah M. Gallaher, S. E. Downs: Proper adjustment of history courses in high schools so as to articulate closely with the elementary school and meet college requirements, p. 336-38, 338-39. 3. H. B. Davis, F. W. Wright: Legitimate scope of the small high school in relation to the normal school, p. 339-40, 340-42. 4. J. T. Morris, D. H. Robbins: Needed changes in the teaching of mathematics in the high school, to meet the demands of the industrial school, p. 342-43, 343-45. 5. Jane Mathews: Work on high school mathematics to be done by the International commission on the teaching of mathematics, p. 345-47. Discussion, p. 347-49. 6. Edwin Lee, J. B. Geissinger: Legitimate scope of the small high school in relation to preparation for college, p. 349-53, 354-56. 7. E. E. Sparks: Shifting ideals and how to meet them, p. 358-64. 8. E. M. Phillips: What state inspection has done and is doing for the schools of Minnesota, p. 364-70. 9. David Snedden: Practical results of the professional training of secondary school teachers in certain American states, p. 370-72.

160. **Public education association of Worcester, Massachusetts.** Fourth annual report, May 1909. 51 p. 8°. (Mrs. Joseph H. Robinson, secretary, 106 Pleasant street, Worcester, Mass.)

Contains: 1. W. H. Burnham: A modern system of school administration, p. 13-21. 2. Mary E. Barrell: Physical education, p. 32-34. 3. L. C. Miller: Medical inspection, p. 34-39.

161. **Schoolmasters' association of New York and vicinity.** Sixteenth annual report, 1908–1909. [New York, Vanden Houten company, 1909] 76 p. 8°.

Contains: 1. J. H. Denbigh: Some problems of the secondary school, p. 7–17 (Discussion, p. 17–20). 2. J. G. Croswell: Studying for the market, p. 21–27. 3. Julius Sachs: Recent impressions of modern language teaching in Germany, p. 28–39 (Discussion, p. 39–42). 4. C. D. Larkins: Some impressions of English schools, p. 43–47. 5. W. E. Chancellor: Some neglected factors in the social situation, p. 48–62. 6. N. M. Butler: General problem of college entrance or admission to college, p. 64–75.

—— Seventeenth annual report, 1909–1910. [Cumberland, Md., The Eddy press corporation, 1910] 68 p. 8°. (Arthur M. Wolfson, secretary, New York city)

Contains: 1. Wilson Farrand: Report of committee on conference with colleges, p. 6–7. 2. J. F. Woodhull: The significance of the new requirements in physics of the College entrance examination board, p. 8–16. 3. N. H. Black: The board's new definition in physics, p. 17–21. 4. G. H. Browne: The college examination in English as a test of power, and marking examination papers in English, p. 22–27. 5. Percival Chubb: College entrance requirements in English, p. 28–35. 6. D. V. Thompson: Two of the pupils' needs, p. 36–38. 7. F. S. Curtis: Teaching boys about matters of sex, p. 40–46. 8. R. C. Newton: Sexual purity, p. 47–54. 9. W. H. Eddy: Sex education in a public school, p. 55–63 (Discussion, p. 64–68).

162. **South Carolina state teachers' association.** The proceedings of the thirty-seventh annual meeting, held at Columbia, S. C., Dec. 30, 31, 1908 and Jan. 1, 1909. Abbeville, S. C., Press and banner print, 1909. 41 p. 8°. (E. C McCants, secretary, 1910–11, Anderson, S. C.)

Contains: 1. L. T. Baker, president: Address, The responsibility of the association to the public school system, p. 3–9. 2. W. H. Hand, chairman: Report of Committee on county associations, p. 9–11. 3. W. K. Tate, chairman: Report of Committee on status of the teaching profession in South Carolina, p. 11–19. 4. J. I. McCain: Simplified spelling, p. 20–24. 5. W. Burdell: Public schools and public health, p. 32–37.

163. **South Dakota educational association.** Proceedings of the twenty-seventh annual session held at Lead, November 1–2–3, 1909. Pierre, S. D., The Executive Committee [1909?] 202 p. 8°. (Nina M. Nash, secretary, Aberdeen, S. D.)

Contains: 1. F. L. Cook: Waste in education, p. 27–34. 2. H. A. Ustrud: Annual address, p. 34–38. 3. Eugene Davenport: Industrial education in agricultural communities, p. 38–44. 4. C. G. Lawrence: Industrial education for the rural schools, p. 44–50. 5. T. B. Thompson: Industrial education in Germany, p. 51–65. 6. B. T. Washington: Address, p. 66–68. 7. G. G. Wenzlaff: The field and function of the normal school, p. 70–75. 8. Alexander Strachan: Some imperfectly recognized rights of the student, p. 75–79. 9. S. F. Kerfoot: Standards of efficiency in collegiate education, p. 79–91. 10. A. A. McDonald: Some things that enter into efficient secondary education, p. 92–96. 11. J. C. Blyman: The aim and spirit of high school science, p. 97–99. 12. N. C. Hirschby: Waste in secondary and collegiate education, p. 100–8. 13. J. E. Johnson: Present possibilities of the rural schools, p. 110–16. 14. Miss C. M. Voight: School attendance, plans and experience, p. 116–19. 15. M. M. Ramer: The new compulsory school law, p. 119–24. 16. W. A. Burk: Manual arts for the primary and grammar grades, p. 124–34. 17. E. C. Evans: The retarded pupil, causes and remedies, p. 135–39. 18. Cornelia Stormen: History in the lower grades, p. 139–47. 19. N. P. Lang: The essentials of arithmetic, p. 148–50. 20. Charlotte Bartleson: The ideal story, p. 152–56. 21. Jessie Beebe: The ideal story teller, p. 156–57. 22. Elin Youngstrom: Drawing in the primary grades, p. 158–61. 23. Miss M. E. Wright: What the kindergarten does for the primary teacher, p. 161–66. 24. Adella Beach: What kindergarten training does for the child, p. 167–72. 25. Lucia Watson: Seat work for the country teacher, p. 173–77. 26. L. A. Fell: President's annual address, p. 192–96. 27. Eugene Davenport: Outline of four years work in high school agriculture, p. 197–202.

164. **Southern California teachers' association.** Committee on resolutions. Declaration of principles. Sierra educational news and book review, 6 : 42–46, January 1910.

165. **Tennessee public school officers' association.** Proceedings of the twenty-third annual session, Senate chamber, Nashville, January 11, 12, 13, 1910. Clarksville, Tenn., W. P. Titus, printer and binder, 1910. 129 p. 8°. (P. L. Harned, secretary, Clarksville, Tenn.)

Contains: 1. W. S. Jones, president: Address, p. 25–32. 2. Virginia P. Moore: School improvement work, p. 33–39. 3. W. E. Stephens: School improvement associations, p. 40–41. 4. V. S.

Bright: What is our obligation as teachers, p. 42–46. 5. H. H. Clark: Corn clubs, p. 47–56. 6. S. G. Gilbreath: The course of study in the elementary schools, p. 57–62. 7. G. R. McGee: Normal course of study, p. 63–66. 8. E. H. Boyd: The function of the county superintendent, p. 67–69. 9. Ella Snodgrass: Libraries—how to raise local funds, p. 70–76. 10. A. E. Booth: How to use the library, p. 77–83.

166. **Vermont state teachers' association.** Report of the fifty-ninth annual convention, held in Rutland, October 15, 16 and 17, 1908. Rutland, Vt., The Tuttle co., printers [1909?] 121 p. 12°. (A. H. Harriman, secretary, 1909–10, Middlebury, Vt.)

Contains: 1. P. R. Leavenworth, president: Address, p. 17–28. 2. Gertrude Edmund: The moral training of the teacher, p. 28–39. 3. A. W. Edson: The modern school; its strength and weakness, p. 42–47. 4. Mary Tewksbury: Ancient history, p. 49–56. 5. Harriet Towne: Aims and methods of teaching mediaeval and modern history, p. 56–71. 6. G. S. Wright: Practical mathematics for grammar grades, p. 79–84. 7. Amy Drake: Mental arithmetic—aims and methods, p. 84–89. 8. J. P. Haney: The value of manual training in our public schools, p. 91–103. 9. Edith M. Wills: Scientific temperance instruction in the public schools, p. 103–6.

167. **Virginia state teachers' association.** Annual proceedings, 1908–1909. Announcements, Virginia educational conference Richmond, November 23–26. [Richmond ? 1908?] 96 p. 8°. (Algar Woolfolk, secretary, Courtland, Southampton county, Va.)

Contains: 1. J. D. Eggleston, jr.: The educational progress of the year, p. 28–34. 2. G. H. Lamar: Address, p. 35–40. 3. J. H. Saunders, president: Annual report, p. 41–45. 4. J. H. Saunders: Address to the Maryland teachers' association, p. 46–49. 5. F. W. King: Teachers' retirement fund, p. 50–51.

168. **Washington educational association.** Addresses and proceedings of the twenty-third annual session, Tacoma, December 28–30, 1909. Seattle, Washington, Northwest journal of education, publishers [1910] 224 p. 8°. (O. C. Whitney, secretary, Tacoma, Wash.)

Contains: 1. W. E. Wilson, president: Address, p. 16–20. 2. S. B. McCormick: The nation's challenge to the school, p. 21–35. 3. F. F. Bunker: The reorganization of our school grades, p. 36–42. 4. O. S. Jones: Progress in education in the state of Washington, p. 43–49. 5. N. D. Showalter: Our rural schools: their improvement, p. 49–53. 6. Mary Carpenter: The relation of the grade teacher to the success of the high school, p. 54–61. 7. F. A. Osborn: Side entrance and exits to the high school, p. 61–64. 8. J. H. Morgan: The work of the educational council, p. 67–69. 9. Frank Deerwester: What can be done for the raising of the professional status of the teacher now by preparation, p. 70–73. 10. H. B. Dewey: The professional status of the teacher: what can be done to raise it? Certification, p. 73–75. 11. Mary P. Carpenter: Tenure, p. 76–78. 12. A. H. Yoder: The professional status of the teacher; how raised by a scheme of annuities or pensions, p. 78–82. 13. N. F. Coleman: Professional ethics and esprit du corps, p. 82–84. 14. F. S. Thompson: Some reasons for partial failure in the development of the more important elements of manhood, p. 86–91. Estelle Purinton: Discussion, p. 91–92. 15. E. E. Cave: Bulwarking American institutions by practical civic training in our public schools. Fundamental principles in education, p. 93–104. 16. A. H. Smith: The differentiation of the course in physics for boys and girls, p. 106–8. 17. G. P. Rigg: What should constitute a high school course in botany, p. 109–21. 18. G. P. Senter: Some difficulties in the teaching of chemistry in the high school, p. 122–25. 19. H. B. Dewey: Rural school problem, p. 127–29. 20. A. S. Burrows: Summary of rural needs, p. 130–32. 21. S. S. Busch: To what degree is the normal able to meet the needs of the rural schools? p. 133–35. 22. Almina George: The adaptability of the normal graduate to the rural schools, p. 135–38. 23. Josephine Preston: The rural teacher: the adaptability of the normal graduate to this work, p. 139–41. 24. E. J. Klemme: How may the normal trained teacher be induced to teach in the rural schools? p. 142–45. 25. J. O. Mattoon: How may the normal trained teacher be induced to teach in the rural schools? p. 146–49. 26. Emma H. Koller: Training of the child voice, p. 151–54. 27. Marcella Nachtman: The problem of introducing music, p. 155–58. 28. C. D. Webster: A problem in design, p. 160–65. 29. Nellie Barnett: The home economics movement, p. 166–77. 30. F. W. Morrison: Solution of equations, p. 179–80. 31. C. A. Isaacs: Modern geometry of the triangle, p. 181–83. 32. Mrs. R. E. Friars: History of mathematics in the high school, p. 183–87. 33. Mable Buland: The correlation of composition and literature in high school English, p. 190–93. 34. B. J. Uhl: The place of conversation and composition in high school German, p. 194–98. 35. E. Shorrock: The management of school board affairs, p. 200–4. 36. J. O. Peterson: Penmanship and the pupil, p. 209–13. 37. Stephen Dwan: The teaching of commercial subjects in the high school, p. 214–17. 38. C. F. Beutel: The business college and the teacher, p. 218–21.

169. **West Virginia university. Educational conference.** Proceedings and papers of the seventh annual educational conference, held at West Virginia university, June 25 and 26, 1909. [Morgantown] The University, 1909. 51 p. 8°. (West Virginia. University. Bulletin, series 9, no. 6) (Laura F. Lewis, secretary, Fairmont, W. Va.)

Contains: 1. J. N. Deahl: Professional education for teachers in the normal schools, p. 8-9. 2. C. G. Doney, C. R. Murray: Professional education for teachers in the private and denominational schools, p. 9-11, 11-13. 3. L. B. Hill, S. P. Hatton: Professional education for teachers in the university, p. 14-16, 17-18. 4. W. B. Taylor: Professional training for preachers, p. 18-21. 5. Maxwell Adams: Education in manual training, p. 21-25. 6. Neva A. Scott: Education in domestic science, p. 25-32. 7. T. F. Burk: Commercial education, p. 32-35. 8. J. P. Lawrence: Musical education, p. 35-36. 9. L. F. W. Hildner: Education for engineers. Mechanical engineering, p. 36-39. 10. W. H. Boughton: Education for engineers. Civil engineering, p. 39-44. 11. W. E. Dickinson: Education for engineers. Electrical engineering, p. 44-48. 12. J. W. Knowlton: Education for engineers. Mining engineering, p. 48-51.

170. **Wisconsin teachers' association.** Proceedings of the fifty-sixth annual session, held at Milwaukee, November 12 to 14, 1908. Madison, Wis., Democrat printing company, state printers, 1909. viii, 220 p. 8°. (Katherine R. Williams, secretary, Fifteenth district school no. 2, Milwaukee, Wis.)

Contains: 1. J. F. Woodhull: How the public will solve our problems of science teaching, p. 13-17. 2. E. A. Ross: The shortcomings of history, p. 36-38. 3. R. H. Butler: Shorthand in the high school, p. 40-42. 4. W. A. Scott: Relation of the commerce course at the university to the high schools, p. 42-44. 5. R. P. Kelley: Recent growth in the use of shorthand in the high school curriculum, p. 44-46. 6. Mary D. Bradford: Primary reading: p. 50-52. 7. J. F. Riordan: Course of study, p. 53-54. 8. Neale S. Knowles: The influence of domestic science on good citizenship, p. 55-56. 9. Laura L. Colman: A more uniform course of study, p. 56-57. 10. George Wittich: Folk-dances as physical training for the young in America, p. 60-62. 11. W. L. Bodine: The naughty boy; truancy and its remedies, p. 63-66. 12. S. B. Tobey: The teachers' point of view, p. 69-71. 13. L. A. Bacon: The manual training course of study, p. 101-6. 14. J. A. H. Keith: The great ways of learning, p. 112-19. 15. L. H. Gulick: The health of the child, p. 119-27. 16. H. C. Buell, president: Annual address, p. 127-31. 17. S. L. Heeter: Education of the hand and the head, p. 132-38. 18. G. H. Landgraf: Needed city school legislation, p. 138-45. 19. C. H. Hemingway: Needed legislation for rural schools, p. 145-54. 20. R. C. Denison: The teacher and the state, p. 154-60. 21. L. D. Harvey, chairman: Report of the committee on the constitutional amendment changing the minimum school age from four to six years, p. 160-64. 22. J. W. Olsen: The county superintendency and its place in our educational system, p. 165-70. 23. C. P. Cary: The heart as a factor in education, p. 170-76.

ASSOCIATIONS, SOCIETIES, CONFERENCES, ETC.—FOREIGN

(A list of British societies with officers and brief sketch of each is found in the Schoolmaster's Yearbook for each year.)

171. **Association of head mistresses.** *See* 1464.

172. **British association for the advancement of science. Educational section.** Program at Winnipeg, August 1909. Science, n. s. 30 : 109, July 23, 1909.

173. **Bund deutscher taubstummenlehrer.** *See* 1510.

174. **National education association.** Annual report for the year ending December 31st, 1909. London [Co-operative printing society limited, 1910] 32 p. 8°. (No. 165)

175. **Ontario educational association.** Proceedings of the forty-eighth annual convention, held in Toronto on the 13th, 14th and 15th ot April, 1909. Toronto, Warwick bro's & Rutter, limited, 1909. 431 p. 8°. (R. W. Doan, general secretary, Toronto)

Contains: 1. W. H. Ballard: President's address, p. 80-88. 2. Charles DeGarmo: Some modern ideas in education, p. 91-105. 3. Charles DeGarmo: Problem form of instruction, p. 109-21. 4. A. H. Colquhoun: Address, p. 121-28. 5. U. J. Flach: Secondary schools of England with special reference to the scope, character, and methods of teaching mathematics, p. 129-37. 6. W. J. Sykes: Secondary schools of Great Britain, p. 137-43. 7. Baron Nettelbladt: Address in German,

p. 144-52. 8. Carl Lehmann: Science teaching in German secondary schools, p. 174-82. 9. J. Matheson: A view of education applied to geometry, p. 183-90. 10. A. McVicar: History and Canadian citizenship, p. 191-97. 11. W. E. Macpherson: Supplementary reading in the lower school, p. 198-204. 12. W. J. Sykes: English literature for junior matriculation and entrance to normal schools, p. 205-8. 13. Clara Brenton: [Kindergarten department] President's address, p. 251-7. 14. Lillian B. Harding: The educational value of stories, p. 257-61. 15. Ida Hillman: The influence of good pictures, p. 261-66. 16. S. J. Radcliff: History in the public schools, p. 267-72. 17. J. R. Seavey: Why we teach art in the public schools, p. 272-82. 18. G. K. Mills: Departmental aid to teachers, p. 283-87. 19. Arthur Brown: Exemption from examination upon the teacher's recommendation, p. 287-93. 20. H. H. Burgess: Fifth classes in rural schools, p. 293-96. 21. N. W. Campbell: A compulsory attendance act, p. 296-303. 22. A. McPhedran: Medical inspection of schools, p. 304-10. 23. S. Truman: Military training in the schools, p. 311-17. 24. Robert McKnight: Our public schools then and now, with a glance at what may be anticipated in the future, p. 318-23. 25. W. T. Wilkins: Might not a larger place be profitably assigned in our educational system to night schools and evening classes? p. 323-30. 26. J. E. Farewell: How the teacher and trustee can supply material for local history, p. 330-37. 27. J. B. Dow: Rhodes scholarships, p. 337-42. 28. J. E. Hett: The benefits derived from physical training and medical inspection, p. 342-48. 29. T. A. Reid: The state and its primary schools, with some present problems, p. 348-59. 30. Miss A. L. Laird: English household science training schools, p. 361-65. 31. J. Roberts: The relation of teacher and nurse to medical inspection, p. 366-77. 32. J. H. Elliott: Education in hygiene—a means to protect the home and household from tuberculosis, p. 384-91. 33. Edward Faw: Connecting the kindergarten and manual training, p. 404-12. 34. A. N. Scarrow: Manual training from a mechanic's viewpoint—design and construction, p. 413-20.

176. **Parents' national educational union.** *See* 1187.

ASSOCIATIONS, SOCIETIES, CONFERENCES, ETC.—INTERNATIONAL

177. **International kindergarten union.** *See* 514, 515.

178. **Société des professeurs de langues vivantes de l'enseignement public.** Congrès international. *See* 674.

DOCUMENTS

179. **U. S. Bureau of education.** Report of the Commissioner of education for the year ended June 30, 1909. v. 1-2. Washington, Government printing office, 1909. 8°.

Contains: 1. Educational boards and commissions, p. 33-52. 2. Educational associations, conferences, etc., p. 52-87. 3. Standardization of education, p. 99-105. 4. Aid to students, p. 106-8. 5. Public schools, p. 110-14. 6. Training of teachers, p. 114-16. 7. Teachers' tenure, salaries, pensions, etc., p. 117-21. 8. Departments and branches of study, p. 122-37. 9. Agricultural education, p. 137-50. 10. Industrial training, p. 150-75. 11. Home economics, p. 175-78. 12. Co-education of the sexes, p. 178-86. 13. International congresses, p. 187-203. 14. International education relations (including Chinese students in United States), p. 203-22. 15. Health and hygiene, p. 222-27. 16. Compulsory education and child labor laws, p. 228-33. 17. Education of the colored race, p. 234-39. 18. C. S. Foos: State educational associations, p. 251-74. 19. Education in Hawaii, p. 275-77. 20. Education in the Philippines, p. 279-309. 21. Education in Porto Rico, p. 311-22. 22. L. S. Rowe: Educational progress in the Argentine Republic and Chile, p. 323-62. 23. Education in Great Britain and England, p. 363-94. 24. Education in Scotland, p. 394-401. 25. Education in Ireland, p. 401-3. 26. Education in France, p. 405-44. 27. Education in Central Europe, p. 445-501. 28. E. M. Goldsmith: Schools for crippled children abroad, p. 503-11. 29. John Fryer: The educational reform in China, p. 513-21.
(Volume 2 contains statistical matter.)

DIRECTORIES

180. American college and private school directory, compiled and ed. by Harry J. Myers. vol. III (Third year). Chicago, New York, Educational aid society [1909] 252 p. 8°

181. **Patterson's** college and school directory of the United States and Canada, compiled and ed. by Homer L. Patterson. vol. 6, 1909. Chicago, American educational company, 1909. 703 p. 8°

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182. **Bayliss, Clara Kern.** The development of education. Education, 30: 561-70, May 1910.

183. **Damseaux, Eugène.** Histoire de la pédagogie à l'usage des élèves des écoles normales et des membres du corps enseignant. Liège, H. Dessain, éditeur; Paris, Ve Magnin et fils, 1910. iv, 607 p. 12°.

184. **Heigenmooser, Joseph** *and* **Bock, Alfons.** Geschichte der pädagogik. Quellenbuch und überblick der geschichte der pädagogik, mit besonderer berücksichtigung der bayerischen erziehungs- und schulgeschichte. München, C. A. Seyfried & comp. (C. Schnell) [1909] 280, 239 p. 8°.

    Comprehensive treatment of the subject, giving much biographical information concerning the early German school teachers. The general history begins with the time of Christ and the apostles.

185. **Paolucci, Ant.** Le vicende del lavoro nella storia dell'educazione, con prefazione del prof. Francesco Orestano. Roma-Milano, Società editrice Dante Alighieri di Albrighi, Segati e c., 1910. 269 p. 16°.

186. **Rausch, Erwin.** Geschichte der pädagogik und des gelehrten unterrichts im abrisse dargestellt. 3. verb. und verm. aufl. Leipzig, A. Deichert'sche verlagsbuchhandlung nachf. (G. Böhme) 1909. 202 p. 8°.

187. **Schiele, Friedrich Michael.** Geschichte der erziehung; vier vorlesungen, gehalten im ersten Stuttgarter hochschulkursus für lehrer und lehrerinnen, 1909. Leipzig, Dürr'sche buchhandlung, 1909. 166 p. 8°.

188. **Schorn, August,** *ed.* Geschichte der pädagogik in vorbildern und bildern . . . fortgeführt von Hermann Reinecke, . . . später Dr. Julius Plath. . . . Nach den neuen bestimmungen vom 1. Juli 1901 bearbeitet von Friedrich von Werder. 25. aufl. hrsg. von Wilhelm Ewerding. Leipzig, Dürr'sche buchhandlung, 1909. 522 p. 8°.

189. **Taylor, William James.** A syllabus of the history of education. Boston, D. C. Heath & co., 1909. 147 p. 12°.

190. **Zenz, Wilhelm, Frank, Ferdinand** *and* **Siegert, Eduard.** Geschichte der pädagogik. Wien, A. Pichlers witwe & sohn, 1910. x, 520 p. 8°.

191. **Ziegler, Theobald.** Geschichte der pädagogik, mit besonderer rücksicht auf das höhere unterrichtswesen. 3., durchgesehene und ergänzte aufl. München, C. H. Beck, 1909. x, 416 p. 8°.

    "Quellen und literatur": p. 11-16.

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192. **Cole, Percival R.** Later Roman education in Ausonius, Capella and the Theodosian code; with translations and commentary. New York, Teachers college, Columbia university, 1909. 39 p. 8°. (Teachers college, Columbia university. Contributions to education, no. 27)

193. **Walden, John W. H.** The universities of ancient Greece. New York, C. Scribner's sons, 1909. 367 p. 8°.

    An account of the Greek educational world during the first five centuries of the Christian era, taking up every side of the life.

194. **Ziebarth, Erich.** Aus dem griechischen schulwesen, Eudemos von Milet und verwandtes . . . Leipzig [etc.] B. G. Teubner, 1909. vi, 149 p. 8°.

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195. **Graves, Frank Pierrepont.** A history of education during the middle ages and the transition to modern times. New York, The Macmillan company 1910. xv, 328 p. 12°.

"He has made of dry historical facts a narrative, full of interest, one that touches the life, politics, religion, and philosophy of the times. His critical summaries are most helpful; one is continually impressed with his desire to be fair."—Pedagogical seminary, December 1910, p. 535.

196. **Paetow, Louis John.** The arts course at medieval universities with special reference to grammar and rhetoric. Urbana-Champaign, University press [1910] 134 p. 4°. (University of Illinois. The University studies, vol. iii, no. 7)

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197. **Cable, Lucy Leffingwell.** School-children the world over, with stories and descriptions, by Lucy Dunton [pseud.] New York, F. A. Stokes company [1909] 78 p. 4°.

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200. **Birdseye, Clarence F.** The General education board. American college, 1 : 381-89, 467-74, February, March 1910.

201. **Bowden-Smith, A. Georgette.** An English student's wander-year in America. London, E. Arnold, 1910. xii, 328 p. 12°.

An account of American schools and colleges and American civilization as seen by an alert fair-minded English woman.

202. **Bruce, Philip Alexander.** Education. *In his* Institutional history of Virginia in the seventeenth century. New York and London, G. P. Putnam's sons, 1910. v. 1, p. 291-459.

203. **Chapman, John Jay.** Learning. Atlantic monthly, 106 : 125-36, July 1910.

204. Contributions to the history of American teaching. I, II (Aaron Gove), III (Charles Super), IV (John H. Hewitt), V (James M. Greenwood). Educational review, 38 : 179-81, 493-506, 39 : 53-60, 227-37, 40 : 11-29, September, December 1909, January, March, June 1910.

205. **Cubberley, Ellwood P.** Changing conceptions of education. Boston [etc.] Houghton Mifflin company [1909] 70 p. 12°. (Riverside educational monographs, ed. by H. Suzzallo)

Traces development of American education in relation to the introduction of a foreign population and changed conditions of living. The new conception emphasizes the social and industrial problems.

206. **Díaz, Raul B.** Viaje à los Estados Unidos de América; notas sobre educación. Buenos Aires, Establecimiento tipográfico El comercio, 1909. 263 p. illus. 8°.

207. **Downey, James E.** Educational progress in 1909. School review, 18 : 400-23, June 1910.

208. **Folwell, William Watts.** University addresses. Minneapolis, The H. W. Wilson company, 1909. 224 p. 12°.

Contents.—Inaugural address, 1869.—The Minnesota plan, 1875.—The secularization of education, 1881.—The civic education, 1884.

209. **Francis, Alexander.** Americans; an impression. London, A. Melrose, 1909. 256 p. 8°.

Chapters 9-15, p. 119-201, are on the following topics: Education, Coeducation, Secular education, Colleges and character, College athletics, The collegiate task, College fraternities.

210. **Gallinger, Jacob Harold.** General education board . . . Memorandum concerning the General education board along the lines of the promotion of practical farming in the southern states, the development of a system of public high schools in the southern states; and the promotion of higher education throughout the United States . . . [Washington, Government printing office, 1910] 15 p. 8°. ([U. S.] 61st Cong., 2d sess. Senate. Doc. 453)

211. **Gass, Howard A.** Education in Missouri. Missouri school journal, 26 : 403-6, September 1909.

212. **Gayley, Charles Mills.** Idols of education. New York, Doubleday, Page & company, 1910. 181 p. 12°.

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"His idols seem like ideals. Carried out, they would radically and broadly change our present educational system."—Outlook, May 14, 1910, p. 87-88.

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214. **Hart, Albert Bushnell.** White education; Negro education; Objections to education. *In his* Southern South. New York and London, D. Appleton and company, 1910. p. 288-337.

215. **Jackson, George Leroy.** The development of school support in colonial Massachusetts. New York, Teachers college, Columbia university, 1909. 95 p. 8°. (Teachers college, Columbia university. Contributions to education, no. 25)

216. **Kilpatrick, W. H.** Date of the first school in New Netherland. Educational review, 38 : 380-92, November 1909.

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218. **Münsterberg, Hugo.** The standing of scholarship in America. Atlantic monthly, 104 : 453-61, October 1909.

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219. **New South Wales. Department of public instruction.** A report following upon observations of American education. By P. Board, M. A., director of education. Issued by the authority of the Hon. J. A. Hogue, M. P., minister of public instruction. Sydney, W. A. Gulick, government printer, 1909. vi, 63 p. 8°.

220. **Northrop, Cyrus.** Educational advantages of the central west. World to-day, 19 : 855-62, August 1910.

221. **Pritchett, Henry S.** The twentieth century type of education. Hampton, Va., The Institute press, 1909. 8 p. 8°.

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222. **Simkins, J. D.** The keynote of the twentieth century. Ohio teacher, 30 : 245–49, January 1910.

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223. **Snedden, David.** Educational tendencies in America. Educational review, 39 : 13–31, January 1910.

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224. **Sturdy, William A.** The economy of education. Boston, J. D. Bonnell & son, 1909. 384 p. 8°.

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225. **Thomas, David Y.** The cotton tax and southern education. North American review, 190 : 688–92, November 1909.

226. **Van Dyke, Henry.** The spirit of America. New York, The Macmillan company, 1910. xv, 276 p. 8°.

CONTENTS.—Introduction.—The soul of a people.—Self-reliance and the republic.—Fair play and democracy.—Willpower, work, and wealth.—Common order and social cooperation.—Persona development and education.—Self-expression and literature.

"This book contains the first seven of a series of twenty-six conférences, given in the winter of 1908–1909, on the Hyde foundation, at the University of Paris, and repeated in part at other universities of France."

227. **Washington (State) Department of education.** History of education in Washington; preliminary ed. issued for distribution at the A.-Y.-P. exposition; comp. and issued by Henry B. Dewey, superintendent of public instruction. 1909. Olympia, Wash., E. L. Boardman, public printer, 1909. 68 p. 8°.

228. **Winship, A. E.** Education in the South. Journal of education, 70 : 651–52, 680–81, 71 : 31–33, December 23, December 30, 1909, January 13, 1910.

West Virginia, p. 651–52; Virginia, p. 680–81; North Carolina, p. 31–33.

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230. **Wolcott, John D.** The Southern educational convention of 1863. South Atlantic quarterly, 8 : 354–60, October 1909.

231. The year in education. Outlook, 95 : 715–17, July 30, 1910.

232. **Yetter, J. M.** The educational system of Pennsylvania. New York, Cochrane publishing company, 1909. 115 p. 12°.

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Advocates the careful indexing of school reports in order to bring interesting school items to the attention of the parent, taxpayer, social worker, and public-office holder. As an illustration, the report of New York city's superintendent of schools for 1908 is indexed in detail.

234. **Burk, Frederic.** The bankruptcy of "Education." World's work, 18 : 11690–96, June 1909; 11764–67, July 1909.

235. **Cooley, E. G.** The adjustment of the school system to the changed conditions of the twentieth century. Educational bimonthly, 4 : 1–11, October 1909.

236. **Edson, Andrew W.** Indianapolis school work. Journal of education, 71 : 373–74, April 7, 1910.

237. **Hollembeak, Jessie Ryan.** A history of the public schools of Stockton, California. [n. p.] 1909. 173 p. 8°.

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238. **Holliday, Carl.** A brief account of ancient schools, written A. D. 2300. American educational review, 31 : 29–35, October 1909.

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[*See* Education extension.]

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Contents.—A. Moll-Weiss: Introduction: L'Ecole des mères.—E. Boutroux: L'entr'aide familiale.—E. Vheysson: Association, état, famille.—G. Compayré: Ce qui différencie l'éducation des filles de celle des garçons.—Darlu: L'amour maternel dans l'éducation.—A. Lichtenberger: Notes sur les enfants.—P. Malapert: Les sentiments chez l'enfant.—A. Moll-Weiss: L'assistance éducative, L'éducation ménagère et familiale doit-elle être réservée au sexe féminin ?—F. Passy: Ce que les femmes doivent savoir, La responsabilité morale.—Charles Wagner: La poésie des devoirs modestes.

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CHILD LABOR AND EDUCATION

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Contains: 1. O. R. Lovejoy: The federal children's bureau, p. 61–72. 2. E. W. Lord: Vocational direction, or the boy and his job, p. 73–85. 3. David Snedden: Vocational direction, p. 86–90. 4. G. E. Whittemore: The Providence school census system, p. 130–33.

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1202. **Agahd, Konrad.** Lehrerschaft und jugend fürsorge in stadt und land. Berlin, Gerdes & Hödel, 1909. vii, 240 p. 8°.

1203. **Davies, Maud F.** School care committees; a guide to their work. London, T. Burleigh, 1909. 94 p. 16°.

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III. MORAL AND RELIGIOUS EDUCATION

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1208. **King, Henry Churchill.** The future of moral and religious education. Religious education, 4 : 293–304, October 1909.

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1211. **Votaw, Clyde Weber.** Method of school and church in moral and religious education. Religious education, 4 : 410–17, December 1909.

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1213. **Brown, J. Stanley.** The moral atmosphere in secondary schools. Religious education, 4 : 457–61, December 1909.

1214. **Brumbaugh, E. V.** Dangers of the high-school age. Independent, 67 : 873–77, October 14, 1909.

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1216. **Cope, Henry F.** Some text-books on ethics and morals. Religious education, 4 : 575–81, February 1910.

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1265. **Oliver, Charles A.** Preparation for teaching. A standard course for teacher training. Philadelphia, The Westminster press, 1910. x, [133] p. 12°.

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Y. M. C. A.

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INTERNATIONAL CONCILIATION

1279. **American school peace league.** First annual report, October 1909. Boston [1909] 52 p. 8°. (Mrs. Fannie Fern Andrews, secretary, 405 Marlborough st., Boston, Mass.)

The American school peace league was organized in 1908, "to promote, through the schools and the educational public of America, the interests of international justice and fraternity."

Contains: 1. N. M. Butler: The international peace movement, p. 36–37. 2. J. M. Greenwood: Saving nations from themselves, p. 38–47. 3. W. F. Gordy: Teaching peace in the schools through instruction in American history, p. 48–52.

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Contains: 1. P. S. Moxom: What practical education can do for peace, p. 115–16. 2. A. D. White: The colleges and international arbitration, p. 129–30. 3. A. D. White: Report of committee on colleges and universities, p. 130–32. 4. List of colleges and universities co-operating with the Lake Mohonk conference, p. 132–37. 5. W. H. P. Faunce: How we may educate for peace, p. 137–41. 6. L. L. Hobbs: Colleges in their relation to arbitration, p. 143–46. 7. F. C. Bray: Home education regarding the friendship of nations, p. 174–80.

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1283. **Macnaughton, *Mrs.* Myra I. (Kelly)** The American public school as a factor in international conciliation. New York city, American association for international conciliation, 1909. 11 p. 12°. (International conciliation, November 1909, no. 24)

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IV. TYPES OF EDUCATION

HUMANISTIC EDUCATION

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"Reprint from the School review, June, September 1909."

CONTENTS.—Letters [by] James Bryce, James Loeb, William Sloane.—The study of the classics as a training for men of affairs [by] J. W. Foster.—The study of Latin and Greek as a training for practical life [by] C. R. Williams.—The value of the study of Greek and Latin as a preparation for the study of science [by] H. W. Wiley.—The classics and modern life [by] J. B. Scott.

As a member of the Committee of nine of the Classical association of the Middle West and South, Dr. Wiley sent "a circular letter to one hundred prominent scientific men in the United States, teachers, and others, for the purpose of eliciting information respecting their attitude toward the promotion of classical learning and their estimation of its value." The replies are contained on pages 26–32 of Dr. Wiley's paper.

1287. **Benson, Arthur C.** Humanistic education without Latin. Cornhill magazine, 101 : 229–35, February 1910.

A paper read at the Cambridge meeting of the Modern language association. Reply by W. H. D. Rouse, entitled "Humanistic education not without Latin," Cornhill magazine, 102 : 45–50, July 1910. Both articles reprinted in Living age, 264 : 737–42, March 19, 1910; 266 : 433–37, August 13, 1910.

1288. **Edmiston, Homer.** A classical education in America. Atlantic monthly, 104 : 260–73, August 1909.

1289. **Lebrun, Hector.** Moins de Grec et de Latin! Plus de sciences naturelles!! Bruxelles, Misch & Thron; Paris, Marcel Rivière, 1910. 71 p. 16°.

1290. **Snow, T. C.** How to save Greek and other paradoxes of Oxford reform. Oxford, B. H. Blackwell, 1910. 86 p. 12°.

1291. **Storr, F.** Humanistic education without Latin. Journal of education (London) n. s. 32 : 101–3, February 1910.

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1292. **Zielinskiĭ, Faddeĭ Frantsevic.** Our debt to antiquity; tr., with introduction and notes, by H. A. Strong and H. Stewart. London, G. Routledge & sons; New York, E. P. Dutton & co., 1909. xvi, 240 p. 16°.

"Lectures delivered by Professor Zielinskiĭ of St. Petersburg university in the spring of 1903 to the highest classes of the secondary schools in the capital."

VOCATIONAL EDUCATION

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1294. **Bustico, Guido.** L'educazione vocazionale e la scuola. Desenzano, F. Legati e c., 1909. 16 p. 8°.

1295. **Dean, Arthur D.** Vocational education; a reprint from the Annual report of the Education department, submitted January 1910. Albany, New York State Education department, 1910. 26 p. 8°.

1296. **Dodd, Alvin E.** Better grammar grade provision for the vocational needs of those likely to enter industrial pursuits. Manual training magazine, 11 : 97–109, December 1909.

1297. **Flexner, Mary.** A plea for vocational training. Survey, 22 : 650–55, August 7, 1909.

Based on a study of one thousand children who left school to work.

1298. **Gillette, John Morris.** Vocational education. New York, Cincinnati [etc.] American book company [°1910] vii, 303 p. 12°.

"An interesting, but not particularly profound book, in which he sets out in summary form the development of vocational training and its many manifestations in modern and contemporary life and thought. The book is suggestive rather than satisfying."—Educational review, December 1910, p. 536.

1299. **Henderson, C. Hanford.** What is fundamental in vocational education? Sloyd record, no. 13 : 8–18, February 1910.

1300. **High school teachers association of New York City.** Choosing a career; a circular of information for boys. New York, Students' aid committee [1909] 22 p. 8°.

1301. ——— Choosing a career; a circular of information for girls. New York, Students' aid committee [1909] 26 p. 8°.

1302. ——— Students' aid committee. Directing young people in the choice of a vocation. [Brooklyn, N. Y.] Printed for the Student's aid committee [1910] 16 p. 8°.

1303. **Lodge, Thornton H.** Vocational subjects in the secondary school. Educational review, 39 : 333–41, April 1910.

1304. **McKeever, William A.** Assisting the boy in the choice of a vocation. Manhattan, Kans., 1909. 15 p. 8°. (The Industrialist, v. 35, no. 41, June 26, 1909)

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1307. **Monaghan, J. C.** Vocational training and the manufacturer. American school board journal, 39 : 6–7, September 1909.

1308. **Rapp, Eli M.** Vocational possibilities in country schools. [Harrisburg? 1909] 14 p. 8°.

1309. **Snedden, David.** The movement for vocational education and its probable effects on liberal education. American education, 13 : 252–55, 300–4, February, March 1910.

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1311. **Webster, Homer J.** Breadth in education and the choice of a career. Ohio educational monthly, 58 : 485–88, September 1909.

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1312. **Eastern manual training association.** Proceedings, fifteenth annual convention, held at Business high school, Washington, D. C., April 13, 14, 15, 1908. [Springfield, Mass., The F. A. Bassette company] 1908. 122 p. 8°. (Irene E. McDermott, secretary, Allegheny, Pa.)

Contains: 1. J. C. Park: Fundamental principles of manual training, p. 15–18. Discussion, p. 19–21. 2. W. J. De Catur: The content of the course of study for the grades and high school, p. 22–25. 3. G. E. Myers: Correlation based on social and individual needs, p. 26–31. Discussion, p. 32–34. 4. A. E. Dodd: Hand work training for the normal student, p. 42–48. 5. T. D. Sensor: The needs of rural schools, p. 55–61. 6. Mrs. Ada Williams: The social value of domestic science training, p. 77–80. 7. Sarah E. Bowers: Aims of domestic science in the elementary schools, p. 81–86.

1313. **Western drawing and manual training association.** Proceedings of meeting held at Central high school, Saint Louis. Sixteenth annual report, 1909. [Bloomington, Ill., Pantagraph ptg. and sta. co., 1910] 208 p. 8°.

Contains: 1. C. H. Walker: Art in education, p. 17-27. 2. J. S. Ankeney: The place and scope of art education in the university, p. 28-35. 3. H. Smith: Art as an integral part of university work, p. 36-39. 4. F. O. Sylvester: Esthetic and practical values in art courses, p. 40-45. 5. E. H. Wuerpel: The art school as a factor in community progress, p. 46-47. 6. F. M. Mann: Cooperation among art workers in universities, p. 48-50. 7. E. H. Wuerpel: The relation of the art school to the university, p. 51-53. 8. Janette Reitler: Art from the standpoint of the normal school, p. 54-56. 9. L. S. Silke: Color training in the schools, p. 57-65. 10. Jeanette Buckley: The aims of the art teacher, p. 66-67. 11. E. A. Batchelder: The study and practice of design, p. 68-73. 12. E. D. Day: The socio-economic value of domestic art in the education of future home makers, p. 87-92. 13. C. M. Gibbs: Preparation necessary for a teacher of domestic arts, p. 93-100. 14. K. F. Steiger: The place of the study of clothing in the life of a girl, p. 101-3. 15. C. M. Gibbs: Household arts in the grades, p. 105-8. 16. C. M. Woodward: History and influence of the manual training movement, p. 122-30. 17. C. F. Perry: Trade teaching in the public schools, p. 131-42. 18. Ida H. Clark: The working out of the arts in the schools, p. 151-53. 19. L. W. Wahlstrom: Controlling ideas in the working out of a course of study in the arts, p. 154-57. 20. Florence Ellis: The manual arts in the primary grades, p. 158-59.

1314. ——— Seventeenth annual report, Minneapolis, 1910. [Oak Park, Ill., Oak leaves company, 1910] 239 p. 8°.

Contains: 1. H. T. Bailey: How to study pictures, p. 17-29. 2. May Gearhart: The grade teacher's art problem, p. 30-35. 3. H. N. Winchell: Problems involved in the introduction of the industrial arts in the elementary schools, p. 36-42. 4. L. A. Bacon: Correlation of art and manual training in grade schools, p. 43-44. 5. H. Wood: The correlation of art and manual training in high schools, p. 45-51. 6. O. L. McMurry: Bookbinding in grade schools, p. 52-55. 7. W. Sargent: Fine and industrial art in public education, p. 56-62. 8. R. W. Selvidge: Industrial education from the viewpoint of organized labor, p. 63-74. 9. E. M. Church: Relative values of subjects in school courses of study, p. 76-80. 10. C. Reed: Creative picture study, p. 81-88. 11. A. F. Payne: The correlation of metal work and design in the grammar and high school, p. 90-94. 12. D. Upton: Is manual training worth while?, p. 95-100. 13. Mary S. Snow: Correlation of household arts with other subjects of the curriculum, p. 107-10. 14. A. P. Norton: Domestic science in public schools in relation to the pure food law, p. 111-15. 15. O. Heller: Art as a liberal study, p. 126-29. 16. J. Jastrow: The place of the study of art in a college course, p. 130-34. 17. Henriette Clopath: The scope and organization of art instruction in the A. B. course, p. 136-39. 18. H. R. Cross: The college degree in fine arts, p. 140-42. 19. H. Smith: The future of the university round table, p. 143-46. 20. C. A. Bennett: Some suggestive features of industrial education in Germany, p. 147-56.

1315. **Bailey, Henry Turner.** Instruction in the fine and manual arts in the United States; a statistical monograph. Washington, Government printing office, 1909. 184 p. 8°. (U. S. Bureau of education. Bulletin, 1909, no. 6)

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1316. **Bennett, Charles A.** Visiting manual training schools in Europe. I, II, III, IV, V. Manual training magazine, 11 : 1-26, 109-34, 214-36, 345-65, 440-55, October, December 1909, February, April, June 1910.

1. London. 2. Oxford and Birmingham. 3. Leicester and Sheffield. 4. Manchester and Leeds. 5. Glasgow and Edinburgh.

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1318. **Bhabha, H. J.** Special report on manual training in schools of general education. Bangalore, Government press, 1909. 145 p. illus. 8°.

1319. **Binns, Charles L.** *and* **Marsden, Rufus E.** Principles of educational woodwork, a handbook for teachers and others interested in education. London, J. M. Dent & co.; New York, E. P. Dutton & co. [1909] viii, 310 p. 12°.

"The teacher and his reading": p. 61-71.

Suggestions for teaching woodwork, with emphasis on the need that manual training teachers be as well equipped on the pedagogical side as teachers of other subjects.

1320. **Boone, Cheshire Lowton.** A course of study in manual training—VII, VIII. Manual training magazine, 11 : 46–58, 410–17, October 1909, June 1910.

1321. ——— Pottery craft in schools. I, Equipment; II, Building processes; III, Design. School arts book, 9 : 118–26, 329–40, 925–34, October, December 1909, May 1910.

1322. **Clark, Ida Hood.** Manual arts in open air schools. School arts book, 9 : 1045–51, June 1910.

1323. **Davis, B. M.** The present status of manual training in its relation to industrial education in the rural schools. Manual training magazine, 11 : 456–61, June 1910.

1324. **Great Britain. Board of education.** Manual instruction in public elementary schools. London, Printed for H. M. Stationery off., by Eyre & Spottiswoode, 1910. iv, 34 p. 8°.

1325. **Noyes, William.** The ethical values of the manual and domestic arts. Manual training magazine, 11 : 201–13, February 1910.

1326. ——— Handwork in wood. Peoria, Ill., Manual arts press, 1910. 231 p. illus. 8°.

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1327. **Rathmann, Carl Gustav.** The mission of manual training; an address . . . before the graduating class of the Manual training school of Washington university, June 23, 1909. With an appendix containing the opinions of educators in England, Germany, Austria and Australia. [St. Louis] The Managing board of the school [1909] 23 p. 8°.

1328. **Reading, Pa. Board of education.** Report of superintendent on manual training. (C. S. Foos, superintendent.) *In its* Minutes, March 23, 1909. p. 34–72. *Also in its* Biennial report, 1907–1909, p. 514–50.

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1329. **Row, Robert Keable.** The educational meaning of manual arts and industries. Chicago, Row, Peterson and company [1909] 248 p. 12°.

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1331. **Selden, Frank Henry.** The equipment of manual training departments in the public schools. American school board journal, 41 : 4–5, 30, July 1910.

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1333. **Sloan, Percy H.** The organization of the arts in the high schools. Educational bi-monthly, 4 : 182–90, February 1910.

1334. **Williams, S. Horace.** The educative value of manual training. I, II, III. Manual training magazine, 11 : 36–45, 158–67, 252–60, October, December 1909, February 1910.

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1337. ——— Proceedings of the third annual meeting, Milwaukee, Wis., December, 1909. New York, National society for the promotion of industrial education, 1910. 204 p. 8°. (*Its* Bulletin, no. 10) (Edward H. Reisner, secretary, New York)

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Includes Preliminary report of the Committee of ten, H. S. Pritchett, chairman, submitted at the second annual meeting of the Society, Nov. 19–21, 1908, and Final report, submitted at the third annual meeting, Dec. 2–4, 1909.

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Contains: 1. J. F. McElroy: President's address, p. 7–8. 2. Rush Rhees: The national importance of industrial education, p. 9–17. 3. Mary S. Woolman: Industrial education for girls, p. 18–23. 4. E. G. Miner: Industrial education from the point of view of the manufacturer, p. 24–33. 5. P. M. Strayer: Industrial education from the point of view of the workman, p. 34–47. 6. Charles De Garmo: Industrial education in relation to race development, p. 48–57. 7. G. M. Forbes: The factory school of Rochester, p. 58–67. 8. A. D. Dean: Preparatory trade schools in other parts of New York State, p. 68–71. 9. C. W. Cross: The apprenticeship system of the New York Central lines, p. 78–86. 10. G. H. Vose: Industrial schools in Beverly, Mass., p. 91–98.

1340. **Alexander, Magnus W.** The training of men—a necessary part of a modern factory system. [New York, 1910] p. [33]–49. 8°.

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1404. **Davis, Benjamin Marshall.** Agricultural education. Elementary school teacher, 10 : 101–9, 163–76, 277–86, 376–87, 444–52, November, December 1909, February, April, May 1910.

The United States Department of agriculture, p. 101–9. United States Bureau of education; state departments of education; state legislation, p. 163–76. Agricultural colleges, including extension work, departments of agricultural education, and summer schools for teachers, p. 277–86. State normal schools, p. 376–87. National education association; state and other teachers' associations, p. 444–52. Bibliography follows each article.

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1426. **Ford, George B.** Phases of architectural education. Technology review, 12 : 1–6, January 1910.

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1427. **Stevenson, Adlai E.** Education and business leadership. Chicago, University extension association, 1909. 16 p. 8°.

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1429. **Burr, William H.** Sanitary engineering at Columbia university. Columbia university quarterly, 11 : 469–71, September 1909.

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1430. **American federation of arts.** Proceedings of the convention at which the American federation of arts was formed, held at Washington, D. C., May 11, 12, and 13, 1909. Washington, Press of B. S. Adams, 1909. 175 p. 8°.

Contains: Art in the public schools, address by Elmer Ellsworth Brown, p. 50–54, followed by discussion, p. 54–59; Art education in the United States, by Walter Scott Perry, p. 132–40.

1431. ——— Proceedings of the first annual convention, held at Washington, D. C., May 17, 18, 19, 1910. [2]–119 p. 8°. (Supplement to Art and progress, v. 1, no. 9, July 1910) (Leila Mechlin, secretary, 1910)

Contains: 1. J. F. Hopkins: The international congresses on art education, p. 83–87. 2. T. L. Blayney: The history of art in the college curriculum, p. 96–103. 3. M. Carroll: Archeology as an educational factor in the popular appreciation of art, p. 109–12. 4. H. K. Bush-Brown: Art education, p. 112–17.

1432. **Eastern art teachers' association.** Proceedings, New York meeting of the Eastern art teachers' association, May 1908. Joint meeting of the Eastern art teachers' association and Eastern manual training association, Pittsburg, May 1909. [Newark, N. J., Printed by Baker printing company, °1910] 317 p. 8°. (C. L. Boone, editor, Montclair, N. J.)

Contains: 1. D. W. Ross: The teaching of art in the public schools. What it should be, p. 14–32. 2. H. W. Mabie: The creative spirit in teaching, p. 33–48. 3. A. G. Randall: The duties and opportunities of the art supervisor as a citizen, p. 49–58. 4. Stella Skinner: Art teaching in normal schools, p. 59–69. 5. J. P. Haney: Pencil sketching from nature, p. 70–84. 6. Alicia M. Keyes: Experiments in connecting Boston schools with the museum of fine arts and with Fenway court, p. 85–91. 7. W. S. Perry: The study of historic ornament, p. 92–108. 8. M. B. Soper: Should art in the high school be for the talented few? p. 109–11. 9. Walter Sargent: Drawing in intermediate grades, p. 112–14. 10. J. W. Beatty: The relation of the institute to school work, p. 128–32. 11. A. A. Hammerschlag: The influence of arts and crafts on education, p. 133–36. 12. L. S. Thomson: Progressive snap-shot drawing, p. 137–43. 13. Kate C. Simmons: The English schools, p. 144–51. 14. Mary C. Wheeler: The third international congress, London, 1908, p. 152–71. 15. Annie B. Durfee: A justification for cookery in grammar schools, p. 172–74. 16. Helen Livingston: Cooking in the high school, p. 174–76. 17. Miss C. L. West: Domestic science, p. 177. 18. A. E. Dodd: Better grammar grade provision for the vocational needs of those likely to enter industrial pursuits, p. 177–92. 19. E. E. MacNary: Industrial studies in manual training, p. 192–202. 20. S. H. Church: Art for the people, p. 203–8. 21. H. T. Bailey: The interrelations of drawing and making, p. 209–16. 22. S. Hamilton: Three types of educational heart-hunger, p. 217–30. 23. A. W. Dow: Design and nature study by mediaeval stone cutters, p. 233–41. 24. L. W. Miller: London congress, p. 242–46. 25. G. W. Gerwig: The segment or the circle, p. 247–56. 26. Herman Schneider: The cooperative idea in industrial education, p. 257–67. 27. J. F. Barker: Vocational training in a modern technical high school, p. 268–74. 28. Bonnie E. Snow: The planning of a course of study in art instruction for public schools, p. 275–78. 29. Daniel Upton: Elementary manual training is necessary in the new industrial education, p. 279–83.

1433. **International congress for the development of drawing and art teaching.** Report of the American committee, third International congress for the advancement of drawing and art teaching. [Montclair, N. J., The E. Madison co.] 1909. 16 p. 8°.

1434. **Western drawing and manual training association.** *See* 1313, 1314.

1435. **Eliot, Charles W.** **Public art education.** **School arts book, 9 : 3–10, September 1909.**

An address by Dr. Charles W. Eliot, delivered at the annual meeting of the Alumni association of the Massachusetts normal art school, Boston, April 16, 1909. Reprinted from the school magazine, the Centre of vision.

Law

1436. **Association of American law schools.** Proceedings of the ninth annual meeting, held at Detroit, Mich., August 25–26, 1909. [n. p., n. d.] 140 p. 8°. (William R. Vance, secretary-treasurer, George Washington university, Washington, D. C.)

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Contains: 1. H. D. Hazeltine: Legal education in England, p. 50–111. 2. J. H. Wigmore and F. B. Crossley: A statistical comparison of college and high school education as a preparation for legal scholarship, p. 112–36. 3. H. P. Judson: Education preparatory to a university law school course, p. 137–40.

1437. **Terry, Charles T.** Law as an education study. Columbia university quarterly, 12 : 25–31, December 1909.

Medicine

1438. **American medical association. Council on medical education.** Fifth annual conference, held at Chicago, April 5, 1909. Chicago, The Association, 1909. 169 p. 8°. (American medical association bulletin, v. 5, no. 1, September 15, 1909) (N. P. Colwell, secretary of Council, Chicago, Ill.)

Contains: 1. A. D. Bevan, chairman: Address, p. 1–4. 2. N. P. Colwell, secretary: Report, p. 5–15. 3. Reports on medical curriculum, p. 16–24. 4. C. R. Bardeen: Report on anatomy, p. 24–36. 5. E. P. Lyon: Report on organic and physiologic chemistry and physiology, p. 36–46. 6. W. T. Councilman: Report on bacteriology and pathology, p. 46–48. 7. T. Sollmann: Report on pharmacology, toxicology, and therapeutics, p. 48–70. 8. G. Dock: Report on internal medicine, p. 71–81. 9. C. H. Frazier: Report on surgery, p. 81–88. 10. J. B. De Lee: Report on obstetrics and gynecology, p. 88–98. 11. G. E. DeSchweinitz: Report on diseases of the eye, ear, nose, and throat, p. 98–106. 12. W. A. Pusey: Report on dermatology and syphilis, p. 107–8. 13. F. F. Wesbrook: Report on hygiene, medical jurisprudence and medical economics, p. 108–32. 14. G. W. Webster: The medical curriculum and state boards, p. 132–35. 15. Fleming Carrow: Character of state license examination, p. 135–38. Discussion, p. 138–55. 16. R. H. Whitehead: Some results of higher standards of preliminary education, p. 155–59. Discussion, p. 159–65.

1439. ——— ——— Sixth annual conference, held at Chicago, Feb. 28 and March 1 and 2, 1910. Chicago, The Association, 1910. [235]–316 p. 8°. (American medical association bulletin, v. 5, no. 3, January 15, 1910) (N. P. Colwell, secretary of Council, Chicago, Ill.)

Contains: 1. A. D. Bevan, chairman: Address, p. 241–52. 2. N. P Colwell, secretary: Report, p 252–74. 3. Report of special committee on practical tests at state license examinations, p. 274–78. Discussion, p. 278–84. 4. E. E. Brown, United States Commissioner of education: Standards in medical education as related to standards in general education, p. 284–89. 5. H. S. Pritchett: The obligations of the university to medical education, p. 289–99. 6. J. G. Schurman: The relation of the university to the medical school, p. 299–307. 7. V. C. Vaughan: The functions of a university medical school, p. 307–12. Discussion on the addresses of Dr. Brown, President Pritchett, President Schurman and Dr. Vaughan, p. 312–16.

1440. **Association of American medical colleges.** Proceedings of the nineteenth annual meeting, held at New York, N. Y., March 15 and 16, 1909. 108 p. 8°. (Fred C. Zapffe, secretary-treasurer, University of Illinois medical department, Chicago, Ill.)

Contains: 1. E. H. Long, president: Address, Functions of the medical school, p. 3–18. 2. H. S. Pritchett: Standards of medical education, p. 19–21. 3. J. A. Wyeth: A medical student in 1867, p. 22–26. 4. W. H. Carpenter: The combined course, p. 27–36. Discussion, p. 36–40. 5. F. C. Zapffe: The present status of medical education, p. 41–52. 6. John Rogers: The five-year medical course, p. 53–58. Discussion, p. 58–62.

1441. **Carnegie foundation for the advancement of teaching.** Medical education in the United States and Canada; a report to the Carnegie foundation for the advancement of teaching, by Abraham Flexner, with an introduction by Henry S. Pritchett, president of the Foundation. New York city [°1910] xvii, 346 p. 4°. (*Its* Bulletin, no. 4)

"Mr. Flexner's report is altogether the most valuable contribution to medical education yet made in this country . . . Whether one is searching for details regarding individual schools or is more interested in discussions of the general principles of medical education, he will be repaid by a study of it."—Educational review, October 1910, p. 309.

1442. **Christian, Henry A.** A career in medicine and present-day preparation for it. Science, n. s. 30 : 537–48, October 22, 1909.

Address at the dedication of the department of medicine in Leland Stanford Junior university, September 8, 1909.

1443. **Columbia university.** Proposed plan for an institute of public health and preventive medicine. [New York] 1909. 16 p. 8°.

Report of a committee appointed December 1908, by President Butler.

1444. **Colwell, Nathan Porter.** The need, methods and value of medical college inspection. Chicago, American medical association, 1909. 11 p. 8°.

Reprinted from the Journal of the American medical association. 53:512–15, August 14, 1909.

"Read before the Nineteenth annual convention of the National confederation of state medical examining and licensing boards, Atlantic City, N. J., June 7, 1909."

1445. **Councilman, William Thomas.** The methods and the object of state examinations. Chicago, American medical association, 1909. 15 p. 8°.

Reprinted from the Journal of the American medical association, 53:515–19, August 14, 1909.

"Read at the Nineteenth annual convention of the National confederation of state medical examining and licensing boards, Atlantic City, N. J., June 7, 1909."

1446. **Flexner, Abraham.** Medical education in America. Atlantic monthly, 105: 797–804, June 1910.

1447. **Forbes, Edgar Allen.** Too many medical schools. World's work, 20 : 13164–71, July 1910.

1448. **Howell, W. H.** The medical school as part of the university. Science, n. s. 30 : 129–40, July 30, 1909.

Annual address in medicine, Yale university.

1449. **Lewis, Frederic T.** The preparation for the study of medicine. Popular science monthly, 75 : 65–74, July 1909.

1450. **Tobey, Edward Nelson.** The leading school of tropical medicine. Popular science monthly, 76 : 337–43, April 1910.

1451. **Williams, Harold.** The choice of medicine as a profession. Science, n. s. 31 : 601–8, April 22, 1910.

Training of Nurses

1452. **American society of superintendents of training schools for nurses.** Proceedings of the fifteenth annual convention, held at St. Paul, Minnesota, June 7 and 8, 1909; including Report of the second meeting of the American federation of nurses, Minneapolis, Minnesota, June 9, 1909. Baltimore, J. H. Furst company, 1910. 242 p. 8°. (Miss M. Helena McMillan, secretary, Presbyterian hospital, Chicago, Ill.)

Contains: 1. Mrs. I. H. Robb, president: Address, p. 9–13. 2. Report of committee on education, p. 16–20. 3. Report of the committee of the course in hospital economics, p. 21–26. 4. Bertha Erdman: Training school committees, p. 29–31. 5. Martha M. Russell: Training for obstetrical nursing, p. 33–37. 6. Laura A. Beecroft: Ethics to be observed between training schools, p. 53–57. 7. Helen S. Hay: Preparation for institutional work, p. 70–77. 8. Katherine DeWitt: Preparation for private duty, p. 79–80. 9. Emma L. Stowe: Preparation of nurses for private nursing, p. 80–83. 10. Lila Pickhardt: Preparation of the student nurse for private duty, p. 83–85. 11. M. Adelaide Nutting, president: Address, p. 101–9. 12. R. O. Beard: The university education of the nurse, p. 111–25. 13. Lillian D. Wald: A Federal children's bureau, p. 197–204.

1453. **American society of superintendents of training schools for nurses.** Proceedings of the sixteenth annual convention . . . Baltimore, J. H. Furst company, 1910. 234 p. 4°.

Contains: 1. Julia Stimson: Student government in colleges, p. 117–28. 2. Luella L. Goold: Suggestions as to possibilities of student government in hospital training schools, p. 129–36. 3. Lydia Anderson: Preparation of the teacher for the training school, p. 139–44. 4. F. M. McMurry: The relation of theory to practice, p. 160–68.

1454. **Fenwick, Ethel Gordon.** State registration of trained nurses. Nineteenth century and after, 67 : 1049–60, June 1910.

Music

1455. **Music teachers' national association.** Studies in musical education, history and æsthetics, fourth series. Papers and proceedings of the Music teachers' national association at its thirty-first annual meeting, Northwestern university, Evanston, Ill., December 28–30, 1909. [Hartford, Conn.] The Association, 1910. 252 p. 8°. (F. L. York, secretary, Detroit conservatory, Detroit, Mich.)

Contains: 1. H. D. Sleeper: Practical courses in college studies, p. 118–22. 2. C. G. Hamilton: The basis for academic credit, p. 122–26. 3. Elizabeth B. Bintliff: The emphasis in instruction, p. 126–31. 4. W. F. Bentley: The emphasis in vocal instruction, p. 132–35. 5. E. B. Birge: Music-appreciation in public schools, p. 142–44. 6. L. R. Lewis: The high school curriculum, p. 151–52. 7. Frances E. Clark: The music section of the N. E. A., p. 152–56.

1456. **Case, L. C.** The music situation in the high school. Wisconsin journal of education, 42 : 36–38, 70–72, February, March 1910

1457. **Fleming, Ada M.** Representative high schools of the United States reporting on music in the high school curriculum, May 1909. Educational bi-monthly, 4 : 271–77, April 1910.

1458. **Mason, Daniel Gregory.** The college man and music. Outlook, 94 : 808–10, April 9, 1910.

Theology

1459. **Boyle, Patrick.** The Irish college in Paris (1578–1908). Catholic university bulletin, 15 : 740–53, December 1909.

Bibliography: p. 753.

1460. **Brann, Henry Athanasius.** History of the American college of the Roman Catholic church of the United States, Rome, Italy. New York [etc.] Benziger brothers, 1910. 570 p. illus. 8°.

1461. **Brown, Francis.** The study of theology in New York city. Columbia university quarterly, 12 : 261–67, June 1910.

1462. **Van der Heyden, Joseph.** The Louvain American college, 1857–1907. Louvain, Printed by F. & R. Ceuterick, 1909. x, [5]–412 p. illus. 8°.

V. EDUCATION OF WOMEN

1463. **Association of collegiate alumnæ.** Proceedings of the annual meeting held in Cincinnati, Ohio, October 27–30, 1909. Association of collegiate alumnæ magazine, series 3, nos. 20–21, February, April 1910, p. 21–61, 1–82. (Mrs. Philip N. Moore, general secretary, 3125 Lafayette avenue, St. Louis, Mo.)

No. 20 contains minutes and reports. No. 21 contains: 1. Elizabeth K. Adams: The psychological gains and losses of college women, p. 11–27. 2. Mrs. J. H. Huddleston: A modified college curriculum, p. 28–43. 3. R. C. Bentley: How shall the American college persist? p. 44–60. 4. Marian Parris: College women in non-teaching professions, p. 61–74. 5. Mrs. W. N. Boyd: College women in the home and in society, p. 75–82.

1464. **Association of head mistresses.** Report, 1910. [London, Charles North, The Blackheath press, S. E., 1910] 102 p. 8°. (Miss R. Young, secretary, 92 Victoria street, Westminster, S. W., England)

1465. **Southern association of college women.** Sixth report. [San Antonio, Texas, Wood Brownlee printing co.] 1909. 54 p. 12°.

Summary of address of Elmer Ellsworth Brown on Illiteracy and compulsory school attendance laws, at the meeting in Atlanta, April 1909, p. 13.

1466. **Women's educational and industrial union, Boston, Massachusetts.** Thirtieth annual report, October 1, 1907, to October 1, 1908. [n. p. 1909?] 68 p. 8°. (Henrietta I. Goodrich, executive secretary, 264 Boylston street, Boston, Mass.)

1467. ——— Thirty-first annual report, October 1, 1908, to October 1, 1909. [n. p. 1910?] 54 p. 8°.

1468. **Adams, Elizabeth Kemper.** The psychological gains and losses of the college woman. Educational review, 39 : 238–56, March 1910.

Also in Association of collegiate alumnæ magazine, April 1910, p. 11–27.

1469. **Blandin,** ***Mrs.*** **Isabella Margaret Elizabeth.** History of higher education of women in the South prior to 1860. New York and Washington, The Neale publishing company, 1909. 328 p. 8°.

1470. **Burstall, Sara A.** Modern movements in girls' education. Queen (London) 127 : 694, April 16, 1910.

1471. **Carpenter, Frank G.** College girls of Japan. Moderator-topics, 30 : 91–93, October 7, 1909.

All about the new woman's university and the school for peeresses, founded by the Empress.

1472. **Davies, Emily.** Thoughts on some questions relating to women, 1860–1908. Cambridge, Bowes and Bowes, 1910. 228 p. 12°.

Contains: 1. University degrees and the education of women, 1863, p. 41–62. 2. Secondary instruction as relating to girls, 1864, p. 63–83. 3. Some account of a proposed new college for women, 1868, p. 84–107. 4. On the influence upon girls' schools of external examinations, 1868, p. 108–17. 5. Special systems of education for women, 1868, p. 118–37. 6. Home and the higher education, 1878, p. 138–57. 7. Women in the universities of England and Scotland, 1896, p. 158–200.

1473. **Hayes, Ellen.** Letters to a college girl. Boston, G. H. Ellis co., 1909. 68 p. 12°.

CONTENTS.—Foreword.—College activities.—The elective system.—The study of science.—The study of mathematics.—English and literature.—Undergraduate specializing.—A baccalaureate note.

1474. **Hillis, Annie P.** The serious note in the education of women. Outlook, 94 : 851–55, April 16, 1910.

1475. **Jenkins, Mabel I.** Origin of the Woman's National council of education. Educational foundations, 21 : 579–81, June 1910.

1476. **Marks, Jeannette.** The crowded hours of the college girl. New England magazine, n. s. 42 : 204–7, April 1910.

1477. **Marlborough, Consuelo,** ***duchess of.*** Higher education for women. Outlook, 95 : 792–93, August 6, 1910.

Also in American educational review, 31 : 747–48, September 1910.

1478. **Mirguet, V.** L'éducation de la jeune fille contemporaine spécialement de la jeune fille du monde. Bruxelles, Em. Rossel, imprimeur-éditeur, 1910. 298 p. 12°.

1479. **Repplier, Agnes.** The girl graduate. Century magazine, 80 : 227–30, June 1910.

1480. **Talbot, Marion.** The college, the girl and the parent. North American review, 192 : 349–58, September 1910.

1481. ——— The education of women. Chicago, University of Chicago press, 1910. 255 p. 12°.

"Dean Talbot's little book is a real contribution to the rapidly growing literature on higher education. While dealing avowedly with the education of women, it asserts as a cardinal principle for all discussion that education is fundamentally a social problem which must be studied and dealt with in its relations to economic and social conditions and development."—School review, November 1910, p. 645.

1482. **Walsh, Trevor.** Some recent developments in the education of girls. Parents' review, 21 : 280–91, April 1910.

COEDUCATION

1483. **Armstrong, James E.** The advantages of limited sex segregation in the high school. [Chicago? 1901] p. 339–350. 8°.

Reprinted from the School review, vol. XVIII, no. 5, May 1910.

Read before the Central association of science and mathematics teachers at the University of Chicago, November 1909.

1484. **Grant, Cecil.** English public school morality and coeducation. Parents' review, 837–45, November 1909.

1485. **Hinsdale, Ellen C.** Coeducation again. School review, 18 : 36–39, January 1910.

1486. **Olin, Helen R.** The women of a state university; an illustration of the working of coeducation, in the Middle West. New York and London, G. P. Putnam's sons, 1909. 308 p. 12°.

The coeducational experience of the University of Wisconsin presented as an aid for the solution of present problems in woman's education.

1487. **Zauck, Carl.** Warum und wieweit bedingt der geschlechtsunterschied der schüler eine differenzierung der lehr- und stoffpläne für knaben- und mädchenvolksschulen? Minden i. W., A. Hufeland, 1910. 24 p. 8°. (Lehrerprüfungs- und informations-arbeiten. hft. 44)

VI. SPECIAL CLASSES OF PERSONS

INDIANS

1488. **Lake Mohonk conference of friends of the Indian and other dependent peoples.** Report of the twenty-seventh annual meeting, October 20th, 21st, and 22d, 1909. 214 p. 8°. (C. F. Meserve, secretary, Raleigh, N. C.)

Contains: 1. E. E. Brown: The white man's burden in Alaska, p. 12–16. 2. H. B. Peairs: Results of the work of Haskell institute, p. 53–55. 3. W. W. Pettit: The mission of the public school in the Philippines p. 100–4. 4. Edmund Enright: The Filipino students in the United States, p. 132–38. 5. W. F. Willoughby: The problem of political education in Porto Rico, p. 160–69.

1489. **Leupp, Francis E.** The Indian and his problem. New York, C. Scribner's sons, 1910. 369 p. 8°.

NEGROES

1490. **Dillard, James H.** The Jeanes fund. Independent, 67 : 1259–62, December 2, 1909.

1491. ——— Negro rural schools. Southern educational review, 6 : 303–8, February, March 1909.

1492. **Douglass, H. Paul.** Problems and programs of negro education. *In his* Christian reconstruction in the South. Boston, The Pilgrim press [1909] p. 265–302.

1493. **Hampton, Virginia. Normal and agricultural institute.** Every-day life at the Hampton normal and agricultural institute. Hampton, Virginia, The Press of the Hampton normal and agricultural institute, 1909. 32 p. illus. 8°.

1494. **Ovington, May White.** Closing the little black schoolhouse; second National negro conference results in new organization. Survey, 24 : 343–45, May 28, 1910.

1495. **Washington, Booker T.** A university education for negroes. Independent, 68 : 613–18, March 24, 1910.

ORIENTALS

1496. **Foster, John W.** What young China can learn from America. Chinese students' monthly, 6 : 24–30, November 1910.

See also in same periodical, p. 16–19, article on the Boxer indemnity students of 1910.

IMMIGRANTS AND CHILDREN OF IMMIGRANTS

1497. **Fairman, Charles G.** College-trained immigrants; a study of Americans in the making. New England magazine, n. s. 42 : 577–84, July 1910.

An illustrated account of the American international college at Springfield, Mass.

1498. **Moore, Sarah Wool.** The teaching of foreigners. Survey, 24 : 386–92, June 4, 1910.

1499. **O'Brien, Sara R.** Teaching English to foreigners. School work, 8 : 430–37, February 1910.

THE DESTITUTE (ORPHANS, OUTCASTS, PAUPERS, ETC.)

1500. **Reeder, Rudolph R.** How two hundred children live and learn. New York, Charities publication committee, 1910. 247 p. 12°.

An account of the New York orphan asylum, Hastings-on-Hudson, by its superintendent.

"There are chapters on Dietary, Work, Play, School life, Punishments, Economic and moral training, Religious instruction and so on . . . These chapters are not mere dry, theoretical discussions of the principles involved, but rather a concrete presentation of the actual life interests of two hundred very real children . . . The book is unique and the first of its kind."—Survey February 12, 1910, p. 734.

THE BLIND

1501. **Allen, Edward E.** Impressions of institutions for the blind in Germany and Austria. Outlook for the blind, 3 : 139–48, Winter 1909; 4 : 7–16, Spring 1910.

1502. **Bishop, S. H.** Basis of work for the blind; work of Overbrook. Century, 78 : 82–94, May 1910.

1503. **Campbell, Charles F. F.** Inventory of work for the blind in America. Outlook for the blind, 3 : 119–34, 156–72; 4 : 17–27, Autumn, Winter 1909, Spring 1910.

The "inventory" includes schools, shops, libraries, nurseries, commissions, etc.

1504. **Czily, A.** Conversing with the blind-deaf. Volta review, 12 : 77–85, May 1910.

A description of the various methods employed for communicating with persons who are both blind and deaf.

1505. **Desagher, Maurice.** L'enseignement des aveugles . . . Bruxelles, M. Weissenbruch, imprimeur du roi, 1909. 28 p. 8°.

Extrait de la Revue de Belgique.

1506. **Howe, Samuel Gridley.** Letters and journals, ed. by his daughter, Laura E. Richards. vol. 2. Boston, D. Estes & company, [1909] 8°.

The story of the great work for the blind accomplished by this "servant of humanity," told in his own words.

1507. **Which tactile print for New York city, New York point or braille? Outlook for the blind, 3 : 64-88, Summer 1909.**

A hearing before the Board of education in which the much disputed question of the best system of embossed type for the blind was discussed at length by various authorities.

THE DEAF

1508. **American association to promote the teaching of speech to the deaf.** Report of the proceedings of the eighth summer meeting held at Chicago from June 28th to July 5th, 1909. Association review, 11 : 263-470, October 1909.

1509. **American laryngological, rhinological and otological society.** Symposium on the deaf child from the viewpoint of physician and teacher. Volta review, 12 : 267-318, August 1910.

Papers by Dr. G. Hudson Makuen, Dr. F. R. Packard, Dr. M. A. Goldstein, Dr. A. L. E. Crouter, J. W. Jones, and Mary McCowen, with discussion by Dr. A. Graham Bell and others. To this symposium also belong papers by Dr. J. Kerr Love and Mrs. J. S. Anderson in Volta review, 12 : 143-54, June 1910, and Dr. E. M. Gallaudet in American annals of the deaf, 55 : 342-49, September 1910.

1510. **Bund deutscher taubstummenlehrer.** Bericht über die VIII. versammlung . . . zu Leipzig 3.-6. October 1909. Leipzig, Selbstverlag des Bundes deutscher taubstummenlehrer, 1909. 228 p. 8°

The principal subject of discussion was the instruction of such deaf children as cannot successfully be taught by the oral method. The following resolution was unanimously adopted by the convention of 286 persons, composed of teachers of the deaf and representatives of the German government: "The convention agrees with the author of the paper (Mr. Kische) that there are deaf mutes, although in a limited number, who are not able through the oral method to acquire language sufficiently for the necessities of life. It is desirable that attempts should be made to give these children in some other way the requisite facility for communicating with hearing persons."

1511. **Barton, J. D.** The relation of manual to intellectual training. Teacher of the deaf, 8 : 17-22 and 50-53, January, March 1910.

1512. **Binet, Alfred** *and* **Simon, Th.** Une enquête sur la méthode orale. Année psychologique, 15 : 373-96, 1909 [Translated in American annals of the deaf, 55 : 4-33, January 1910]

The conclusions of these distinguished French psychologists are decidedly unfavorable to the oral method of teaching the deaf. A rejoinder by E. Drouet is published in American annals of the deaf, 55 : 307-25, September 1910.

1513. **Ferreri, Giulio.** Documenti per la storia dell' educazione dei sordomuti raccolti e ordinati. Milano, G. Sulli Rao, 1909. 85 p. 8°. (Biblioteca del periodico "L'educazione dei sordomuti," vol. IV)

The principal document in this volume is a letter written by the Jesuit Abbate Giovanni Andres in 1793, exalting Pedro Ponce above all other teachers of the deaf and protesting against the praises bestowed by his contemporaries upon De l'Epée.

1514. ——— Questioni varie intorno all' istruzione dei sordomuti (1889-1909). Torino, G. B. Paravia e c., 1910. vii, 261 p. 16°

1515. **Long, J. Schuyler.** The sign language. A manual of signs. Being a descriptive vocabulary of signs used by the deaf in the United States and Canada. Washington, D. C., Press of Gibson Bros., [190-?] 164 p. 8°.

The first successful attempt ever made to give in words an accurate description of the signs of the sign language used by the deaf.

1516. **Love, James Kerr.** Cerebral physiology and the education of deaf children. American annals of the deaf, 54 : 293-327, September 1909.

An exposition of the most recent views concerning the localization in the brain of speech, language, sight, and hearing centers, and the bearing of these views upon the education of the deaf.

1517. ——— Deafness in the school child. Teacher of the deaf, 7 : 184-89, November 1909.

Dr. Love maintains that semi-deaf and semi-mute children should reside in their own homes and attend day-schools. He also urges the timely removal of post-nasal adenoids, as likely to lead to improvement in hearing.

1518. **McIlvaine, J. A.,** *jr.* A plea for the feeble-minded deaf. American annals of the deaf, 54 : 444–50, November 1910.

The author shows the importance of making special provisions for this class in schools separate from those for the intelligent deaf and those for the feeble-minded hearing.

1519. **Reuschert, E.** Die gebärdensprache der taubstummen und die ausdrucksbewegungen der vollsinnigen. Leipzig, H. Dude, 1909. 222 p. 8°.

An elaborate treatise on the sign language and its place in the oral instruction of the deaf and in the life of the deaf mute out of school.

1520. **Schumann, Georg** *and* **Schumann, Paul.** Neue beiträge zur kenntniss Samuel Heinickes. Leipzig, E. Wiegandt, 1909. 148 p. 8°.

A sketch of the founder of the instruction of the deaf in Germany, with a bibliography of his manuscripts, letters, and publications.

1521. **Story, A. J.** Voice training for the deaf. Teacher of the deaf, 7 : 190–97, November 1909.

Reports of experiments made in Italy, France, and England to improve the speech of deaf children.

1522. **Thollon, B.** *and others.* Bulletin international de l'enseignement des sourds-muets. Première année. Grenoble, Alber frères, 1909. 53 p. 8°.

Contains a long and valuable symposium in French on lip-reading, with a summary of the opinions expressed in English, German and Italian; also a bibliography.

1523. **Wright, John D.** The speech method of educating the deaf. American educational review, 31 : 219–21, 281–87, 415–21, January, February, April 1910.

CRIPPLED CHILDREN

1524. **McMurtrie, Douglas C.** Jimmy's fight for independence. New York city, 1910. [16 p.] 8°.

Describes the practical work done by the Association for the aid of crippled children, in New York city.

BACKWARD CHILDREN

[*See also* Retardation of pupils]

1525. **National association for the study and education of exceptional children.** Proceedings of the exercises and conferences, inaugurated upon the occasion of the tenth anniversary of the Groszmann school for nervous and atypical children, April 1, 1910. [Plainfield, N. J., National association for the study and education of exceptional children, 1910] vii, 141 p. 8°. (Waldemar H. Groszmann, secretary, Watchung Crest, Plainfield, N. J.)

Contains: 1 F. J. A. Torek: The history and aims of the National association for the study and education of exceptional children, p. 13–17. 2. A. W. Edson: What is being done in the public schools of New York city in the training of exceptional children, p. 18–23. 3. M. L. Bonham, jr.: The problem of defective pupils in the regular schools, public and private, p. 24–30. 4. M. Neustaedter: Why should the exceptional child receive training suited to its needs at public expense? p. 31–34. 5. Arthur Zentler: Oral defects a great hindrance in the proper development of children; the State's duty to cope with these conditions, p. 35–40. 6. H. H. Horne: Remarks on the education of exceptional children, p. 41–43. 7. E. B. McCready: Biological variations in the higher cerebral centers causing retardation, p. 45–53. 8. J. H. Claiborne: Types of congenital amblyopia (word blindness), p. 54–60. 9. C. W. Crampton: The differences between anatomic, physiological, psychological, and chronological age as causes of derailment, p. 70–75. 10. E. L. Hunt: Hereditary and congenital causes of exceptional development, p. 76–85. 11. S. P. Goodhart: The influence of education and environment upon the early development of the exceptional child, p. 86–97. 12. S. V. Haas: The value of prophylaxis in the early life of the exceptional child, p. 98–102. 13. M. P. E. Groszmann: The exceptionally bright child, p. 103–12. 14. W. S. Monroe: The training of teachers for backward and feeble-minded children, p. 114–16. 15. Maurice Fishburg: Ethnic factors in education, p. 117–22. 16. E. K. Coulter: The exceptional child and the law, p. 124–29. 17. M. P. E. Groszmann: Tentative classification of exceptional children, p. 132–34.

1526. **National conference on the education of backward, truant and delinquent children.** Proceedings of the sixth annual session, held in Buffalo, N. Y., June 7th and 8th, 1909. Glen Mills, Pa., The Glen Mills school of printing, 1909. 181 p. 8°. (E. L. Coffeen, secretary, Westboro, Mass.)

Contains: 1. *Mrs.* Ophelia L. Amigh: What can be done with the border-line girl, who is somewhat defective but not feeble-minded? p. 3–7. Discussion, p. 7–16. 2. W. F. Penn: Problems in discipline, p. 16–22. Discussion, p. 22–25. 3. E. L. Coffeen: Cooperation of public school authorities with institutional authorities, p. 26–29. Discussion, p. 29–33. 4. *Mrs.* Anna L. Morrison. The child problem in the smaller towns and rural districts, p. 34–39. Discussion, p. 39–40. 5. J. A. Burnett: How can the cottage life of the delinquent boy and girl be made more home-like, p. 40–48. Discussion, p. 48–54. 6. *Miss* Florence A. McNeal: Ungraded schools for backward children as a means for reclaiming delinquent children, p. 54–67. 7. *Mrs.* J. Ellen Foster: Remarks, p. 68–76. 8. B. Flexner. Juvenile courts from the point of view of the lawyer, p. 77–93. Discussion, p. 93–98. 9. C. W. Skinner: The effect of play in the development of a child, p. 99–106. Discussion, p. 106–12. 10. *Miss* Marian Campbell: How the settlement workers may cooperate with the juvenile courts, p. 112–17. Discussion, p. 117. 11. H. H. Hart: Home-placing, p. 118–26. Discussion, p. 126–31. 12. Report of the special committee on a system of uniform statistics for institutions dealing with defective and delinquent children, p. 135–38. 13. B. D. Bogen: Correctional work among Jewish boys and girls, p. 139–49. Discussion, p. 149–52. 14. *Miss* Grace Johnson: How can the visiting agents of an institution influence the parents and relatives of the children so that the homes to which they will afterwards be returned shall be greatly improved or reformed? p. 153–62. 15. G. B. Robinson: What the New York Catholic protectory is doing for its boys and girls, p. 168–74. 16. F. H. Nibecker: Former conventions and results thereof, p. 174–80.

1527. **Anderson, W. T.** What are we doing for the backward pupil? Wisconsin journal of education, 41: 272–74, October 1909.

1528. **Downing, Bertha C.** Defective speech in backward and feeble-minded children. New York, 1909. 14 p. 12°.

Reprinted from the Medical record, October 30, 1909.

1529. **Greene, Mary B.** A class of backward and defective children. Psychological clinic, 3: 125–33, October 15, 1909.

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1530. **Groszmann, Maximilian Paul Eugen.** Classification of exceptional children as a guide in determining segregation. [Easton, Pa., 1909] 12 p. 8°.

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S. F. PARSONS, State Normal School, De Kalb, Ill.
Dr. J. D. FAUGHT, State Normal School, Marquette, Mich.
J. C. STONE, State Normal School, Montclair, N. J.
W. A. CORNISH, State Normal School, Cortland, N. Y.
G. C. SHUTTS, State Normal School, Whitewater, Wis.
W. C. VERNON, Austin, Tex.

Subcommittee 3. Private Normal Schools.

M. E. BOGARTE, Valparaiso, Ind.
FRED L. PAULY, Lebanon, Ohio.
THOMAS W. KEENAN, Shenandoah, Iowa.
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Subcommittee 4. Teachers for Normal Schools.

J. C. BROWN, Horace Mann High School, New York, N. Y., Chairman.
Dr. JOSEPH V. COLLINS, State Normal School, Stevens Point, Wis.
GEORGE W. HULL, State Normal School, Millersburg, Pa.
J. H. SCARBOROUGH, State Normal School, Warrensburg, Mo.
SANDS WRIGHT, Teachers' College, Cedar Falls, Iowa.

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[1] As originally arranged, the chairman of the committee undertaking this investigation was Prof. George W. Myers, of the University of Chicago. On account of his absence in Europe for the year, his place was taken by Prof. Clifford B. Upton, of Teachers College, Columbia University, New York, N. Y. A part of the report as prepared by him and the rest of the committee appeared in its first form in the Educational Review, April, 1911.

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TRAINING OF TEACHERS OF ELEMENTARY AND SECONDARY MATHEMATICS

SUBCOMMITTEE 1.[1] THE TRAINING OF TEACHERS OF MATHEMATICS IN PROFESSIONAL SCHOOLS OF COLLEGIATE GRADE, SEPARATE FROM OR CONNECTED WITH COLLEGES OR UNIVERSITIES.

Twenty years ago no professional training of university grade existed in this country to prepare teachers of mathematics for secondary schools. At that time the young teacher's sole preparation for his work was the taking of as many academic courses in mathematics as possible, plus, in some instances, a course on the history of education or some lectures on general pedagogy. On graduation he had had no observation of skillful teaching in secondary mathematics, no practice work, no survey of secondary mathematics from a higher and pedagogic standpoint, and no knowledge of the best literature dealing with the teaching of algebra and geometry in this country or abroad. He gained all his experience in the classroom, and, if progressive, he also acquired a certain pedagogic equipment from private reading and from teachers' associations; if not, his point of view on questions of teaching remained narrow, as is always the case when one fails to come into contact with what others are doing in his field of work. A very large number of candidates for teaching begin their work to-day with this modicum of preparation.

About 15 years ago we find conditions throughout the country beginning to change in this respect. At least five different educational institutions[2] had by this time established courses on the teaching of algebra and geometry, which, together with a course on general pedagogy, formed a certain professional training for high-school teaching in mathematics. Up to 1900 only four other colleges[3] are known to this committee to have added courses on the pedagogy of secondary mathematics to their programs.

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[1] No report of the committee as a whole has been prepared, the ground being covered sufficiently well by the reports of the subcommittees that are presented herewith.

[2] University of Michigan (1893), Michigan State Normal College (1893), Teachers College, Columbia University (1894), Syracuse University (1895), and University of Chicago (1895). The dates indicate the year in which the course was first given.

[3] University of Pennsylvania (1897), University of Indiana (1898), Albany Normal College (1898), and University of Illinois (1900).

The past 10 years have shown far greater interest in pedagogical matters and a much more rapid growth in courses of this kind. At present about 25 other colleges,[1] in addition to those above mentioned, have developed such courses as "The history and pedagogy of secondary mathematics," "The teaching of mathematics in secondary schools," and "Teachers' course in algebra and geometry."

For the other high-school studies, such as Latin, English, German, physics, and chemistry, there has been a corresponding development of professional courses on the teaching of these subjects.

This general interest in the professional preparation of teachers for secondary education, which is thus being shown in many of our American colleges and universities, has led to a feeling on the part of a number of these institutions that teaching must be recognized as a profession, and that training for it must be as formal and definite as for law, medicine, or engineering. This has resulted in the establishment at a number of our universities of schools of education, each with a formal organization and a separate faculty, these being considered as professional schools and as such ranking, in general, with the schools of law, medicine, and engineering. In these schools attention has been given particularly to preparation for secondary teaching, as the various State normal schools have, in general, solved the problem of preparing teachers for the elementary schools.

Of the various schools of education now existing in the United States the oldest are Teachers College of Columbia University and the School of Pedagogy of New York University. Teachers College was founded in 1888 as a privately endowed institution under the presidency of Nicholas Murray Butler, and was then known as the New York College for the Training of Teachers. It was a school of university grade and enjoyed reciprocal relations with Columbia University. In 1898 it became one of the professional schools of Columbia University, ranking with the schools of law, medicine, and engineering. Teachers College was the first professional college of education of university grade separate from a university, though now a part of Columbia University.

The School of Pedagogy of New York University, established in 1890, takes rank with the other professional schools of that institution, and may be said to be the first professional school of university grade directly connected with a university.

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[1] Eleven of the more prominent are: New York University (1902), University of Texas (1903), University of Missouri (1903), University of Minnesota (1905), University of Cincinnati (1906), University of Nebraska (1907), Cornell University (1907), University of Wisconsin (1907), University of Iowa (1908), Drake University (1908), and Ohio State University (1909).

In 1901 a school of education with a distinct faculty and ranking as a professional school was opened at the University of Chicago, and has since become one of the prominent institutions of this kind. Within the last five years at least 11 other universities[1] have organized similar schools or colleges where the professional training of teachers is carried on. In all but two cases[2] these schools rank with the other professional schools of the university.

In addition to the above-mentioned institutions connected with universities there are at least three normal colleges,[3] separate from any university or college, where work in the training of teachers is of collegiate grade and leads to a recognized bachelor's degree. These three institutions offer both academic and professional courses in preparation for secondary teaching.

The work in all of the above schools or colleges of education differs from that offered by a university chair or department of education in that professional courses of study are offered in far more generous measure. In these schools one finds courses in general and educational psychology, the history and philosophy of education, school administration, foreign school systems, secondary education, etc., in addition to courses on the teaching of each of the secondary subjects, often accompanied by systematic observation and practice teaching of the subject under expert supervision in some high school. The academic preparation of the prospective teacher is usually carried on for two years in the regular college department of the university before the pupil enters the school of education, and is continued in the college department along with the professional courses in the school of education. In general, academic work is not done in the school of education, the courses there offered being strictly of a professional nature. The principal exception to this is found in those professional schools which are not connected with a university. In all of these schools the professional courses are credited toward the bachelor's degree, and in a few of these institutions graduate courses leading to the master's and doctor's degrees in education are also offered.

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[1] University of Cincinnati, College for Teachers (1905); University of Texas, Department of Education (1906); Syracuse University, Teachers' College (1906); University of Missouri, School of Education (1906); University of Minnesota, College of Education (1906); University of Indiana, School of Education (1907); Ohio State University, College of Education (1907); University of Iowa, School of Education (1907); Drake University, College of Education (1907); University of Illinois, School of Education (1908); University of Nebraska, Teachers' College (1909).

(The dates indicate the year of establishment of the school of education. By a comparison of the above with the footnotes on pages 5 and 6 it will be seen that in some universities courses on the teaching of secondary mathematics existed before the organization of a formal school of education, while in others such courses came after the establishment of the professional school.)

[2] Universities of Illinois and Iowa.

[3] State Normal College, Ypsilanti, Mich.; State Normal College, Albany, N. Y., and Normal College of the City of New York.

It is the purpose of this report to deal only with the training of teachers of mathematics as carried on in the above-mentioned schools or college of education.

THE AIM OF SCHOOLS AND COLLEGES OF EDUCATION.

So far as mathematics is concerned, it is the aim of all of these colleges of education to prepare teachers and supervisors of mathematics for public and private high schools. Some of these institutions also have facilities for equipping teachers of mathematics for departmental work in elementary schools and instructors in methods in mathematics for normal schools. At a few schools of education opportunity is offered to principals and teachers to fit themselves for the study of special problems in the teaching of mathematics, such as constructing courses of study for elementary and high schools, and especially courses in mathematics which fill the particular needs of manual training, commercial, industrial, trade, and other specialized forms of schools. The courses found in several of these professional schools are very helpful to those preparing to teach academic courses in mathematics in colleges and universities, while extensive and complete preparation is possible for those who wish to become professors of the pedagogy of mathematics. Facilities are also offered to prepare for research and teaching in the history of mathematics.

THE PRESENT UNDERGRADUATE PROFESSIONAL PREPARATION FOR TEACHING IN SECONDARY SCHOOLS.

In each of the 17 schools of education considered in this report the minimum training of a professional nature for secondary work is a definitely organized course on the teaching of secondary mathematics. This course varies in length from 17 to 90 hours of class work, the average for all of the institutions being 48 hours. The method of handling the course is, in general, by lectures, recitations on assigned readings, discussions, written reports, and quizzes. The subject-matter of this course varies somewhat in each institution, though certain topics are common to practically all of the courses. That some notion may be formed of what is being done in such work the following composite syllabus, prepared from the syllabi sent in by the leading institutions, has been arranged, and may, therefore, be regarded as a sort of maximum course. The course treats of such topics as the reasons for teaching algebra and geometry, the historical development of these subjects and of the methods of presenting them, the world's best literature concerning the teaching of mathematics, the mathematical curriculum in American and foreign secondary schools. the adaptation of a curriculum to the needs of various types of schools, a study of typical American and foreign texts for secondary schools, and the various movements to reform the teaching of secondary mathematics at home and abroad. Some attention is often given to the methods of conducting a recitation in mathematics with discussions of the heuristic method, the laboratory method, the no-text method, etc. The course also contains a review of typical parts of algebra and geometry offering scientific or pedagogic difficulties, such as the number system of algebra, equivalent equations, factoring, theory of exponents, simultaneous quadratic equations, graphic solutions, the foundations of geometry, the sequence of propositions, the treatment of parallels, loci, limits, incommensurable cases, methods of attacking exercises in geometry, and the nature of the problems and exercises of algebra and geometry. The reading of current periodical literature on the teaching of mathematics and the discussion of such topics as teaching algebra and geometry together, the fusion of plane and solid geometry, etc., are often included.

Such books as Smith's The Teaching of Elementary Mathematics and The Teaching of Geometry, and Young's The Teaching of Mathematics are frequently used as outlines or texts for such a course. Fine's College Algebra and Number System of Algebra, Chrystal's Algebra, and the histories of mathematics by Ball, Fink, Cajori, Gow, and Allman are frequently reported as reference books.

The prerequisites in mathematics for the above course are one year of college mathematics in about half of the cases and through the calculus in others. Even where the former requirement exists, it usually happens that most of the students have had the calculus and such courses as the theory of equations and projective geometry as a minimum preparation before entering the pedagogical course. This pedagogical course is normally taken in the senior year.

In connection with the above course on the teaching of secondary mathematics 12 different colleges of education offer systematic work in observation and practice teaching in secondary classes, which receives academic credit. This work is carried on in most cases in a special high school connected with or under the direction of the school of education. In a few cases arrangements are made for such practical work in public city high schools. The amount of observation and practice teaching required varies from 30 to 60 hours of work.

In some of these colleges other professional courses in preparation for the teaching of mathematics are given in addition to the teachers' course above mentioned. A distinct and separate course on the history of mathematics is offered in seven of these institutions, while in several others such historical work is a definite part of the course on the teaching of mathematics. This historical course aims particularly to show the evolution of the science of mathematics and to trace the causes which have led to its development or stagnation in various epochs. Work in surveying, designed especially for prospective teachers, is also offered at several schools. At Teachers College of Columbia University and at the School of Education of Chicago University several additional interesting professional courses are found, such as "Encyclopedia of elementary mathematics for teachers," "Applied mathematics for teachers in secondary schools," "Psychology of number," "Teaching of secondary mathematics in Europe," and "Critical review of secondary mathematics."

In a few schools special certificates or diplomas, certifying special preparation and fitness for teaching secondary mathematics, are given in addition to the regular degree to students who fulfill certain requirements. In some instances these diplomas are granted by the State board of education to students who have had at the school of education a certain preparation for the teaching of mathematics. In these cases the diploma is a State license to teach for life or for a given number of years. In other instances the diploma is conferred only by the college of education independent of any board of education. The requirements for these diplomas are usually as follows: Courses on educational psychology, the history of education, and the teaching of secondary mathematics, with observation and practice teaching, together with academic work in college mathematics of from 15 to 24 points (a point equaling one hour of work for one semester).

THE PRESENT UNDERGRADUATE PROFESSIONAL PREPARATION FOR TEACHING IN ELEMENTARY SCHOOLS.

Only a few [1] of the schools of education offer preparation for teaching mathematics in elementary schools. One reason for this is that the State normal schools offer, as a rule, sufficient preparation for this field of work. When, however, one wishes to prepare for supervision or departmental work in mathematics in the grades, and hopes to obtain the better positions, it is necessary to have further scholarship in mathematics and education, and a college degree, a type of training which can be found only in the colleges for teachers since they begin, in general, where the normal schools leave off. Students who have done two years of work beyond the high school, in a normal school, are usually able to complete a course and obtain a degree in one of the schools of education by two additional years of study. A part of the preparation for work in the elementary schools is a course on the teaching of arithmetic corresponding to the one described above on the teaching of algebra and geometry. The syllabus is of the same general type as that for secondary mathematics, except that arithmetic and such parts of algebra and concrete geometry as are taught in the elementary school make up the subject matter for discussion. Students taking such a course have often had a year's work in college mathematics, while the most serious students have usually had more. In Teachers College at Columbia University students also take a thorough course on higher arithmetic, in which special attention is given to modern business practices. In the School of Education of the University of Chicago a course on the psychology of number is usually taken. In addition, students generally elect very freely related courses in the departments of psychology and elementary education. Opportunity for practice teaching and observation in elementary mathematics is offered in connection with this work. It should be added that students who are studying seriously the problems of teaching mathematics in elementary schools usually take also the full preparation for teaching in secondary schools, in order that they may better appreciate the nature of the secondary school work to which the elementary school courses are leading.

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[1] Teachers College of Columbia University, School of Education of the University of Chicago, College for Teachers of the University of Cincinnati, Albany Normal College, and the Michigan State Normal College.

GRADUATE COURSES IN THE TEACHING AND HISTORY OF MATHEMATICS.

Graduate courses in the teaching and history of mathematics, leading to the master's and doctor's degrees, are found only at Teachers College of Columbia University and at the School of Education of the University of Chicago. In these two institutions research courses are conducted on the seminar plan, in which the students work on individual topics relating to the history and pedagogy of mathematics. The prerequisite for these courses is a bachelor's degree, which should include a course on the teaching of algebra and geometry in addition to a generous amount of college mathematics. Students who have not had courses on the history and pedagogy of secondary mathematics usually take these courses parallel with the graduate work. A large number of the students pursuing these courses are those who have already had considerable experience in teaching. The work is adapted to the needs of the various classes of students. It is taken by those who wish further preparation for secondary teaching as well as by those who aim to become heads of departments of mathematics in high schools. One also finds a number who are fitting themselves to teach methods in mathematics in normal and training schools.

There are also a few students who are preparing to teach mathematics in colleges and universities. This seems to be a good omen, for it indicates that students are beginning to realize that there are important pedagogical problems to be solved, especially in connection with the teaching of the first year of college mathematics, where, in general, more poor instruction is found than in any other place in our educational system, a situation which is easily explained, since as a rule the teachers in the first year of the college course are young men, fresh from the study of higher mathematics, who have never had experience in teaching and who have never so much as discussed the most elementary topic in relation to such work. The fact that the men who are preparing in the schools of education for this college work usually follow at the same time the courses offered on the teaching of secondary mathematics shows that they realize that the problems of teaching in the first years of college are almost identical with those in the last two years of the high school. France and Germany long ago fully appreciated this when they included in the courses of study for their secondary schools the mathematics which we usually teach in the first two college years. The further fact that these young men also pursue as many advanced courses as possible in pure and applied mathematics indicates that they feel strongly the necessity of combining mathematical scholarship with this pedagogic training. In these schools of education there is no dogmatic instruction in reference to college teaching; such work would be fatal. In the seminars these students usually work out some problem connected with freshman or sophomore college work and, at the same time, get fully into touch with all of the movements and problems in secondary teaching which bear so directly upon their field of work. They thus obtain a broad basis for the pedagogy of freshman college mathematics; they get perspective if nothing else.

In these graduate courses men are also prepared for college teaching and research in the history of mathematics. The facilities for this work are exceptional at Teachers College of Columbia University, where very complete libraries[1] of old mathematical books and manuscripts are available for the use of graduate students. In the seminars one also finds a number of principals and supervisors who are interested in the new types of industrial, trade, and commercial schools, which are so rapidly springing up in this country, and who are working on special studies relative to the courses of study in mathematics adapted to the needs of these schools.

PRESENT TENDENCIES.

A number of the schools of education report plans for enlarging the work for the professional training of teachers of mathematics. In several of these colleges where short courses on the teaching of secondary mathematics are now offered it is proposed to make within a year or so a considerable increase in the length of the course. In a few institutions where no practice teaching or observation is now given, it is hoped to mature arrangements for such work in the near future. In a number of other schools serious efforts are being made to increase the efficiency of this work, especially on the side of practice teaching.[1] Several professors have also announced their intention of offering courses on the history of mathematics; others are planning graduate courses in the teaching of mathematics. At several of our colleges of education there seems to be a strong feeling that secondary teachers should have a synoptic course in mathematics somewhat along the lines of Klein's "Elementarmathematik vom höheren Standpunkte aus." There is no question as to the advisability of such a course; the main reason why such work has not been more generally given in America is probably the lack of a suitable textbook. As a number of American professors are now jointly preparing a work of this kind, courses of this nature will soon be found, no doubt, in a number of our teachers' colleges.

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[1] The large private libraries of Prof. David Eugene Smith and George A. Plimpton, Esq.

CONCLUDING REMARKS.

The ideal preparation for teaching in secondary schools and the first two years of college should be something more complete than that now generally found. On the side of scholarship it should approach the completeness of the preparation in France and Germany, where one must have a State license, obtained only by passing a most rigid State examination, before he can hope to do anything worth while in secondary teaching. On the other hand, it would probably be detrimental to the life and elasticity of our system if a similar license should be demanded in this country. Yet with us, where the public is now beginning to recognize that teaching is a profession, a feeling which will certainly increase as the years go by, the time will undoubtedly come when secondary teaching will be sufficiently attractive financially to enable us to demand from the prospective teacher some such preparation as the following: On the side of pure mathematics we may expect the calculus, differential equations, solid analytic geometry, projective geometry, theory of equations, theory of functions, theory of curves and surfaces, theory of numbers, and some group theory. On the applied side we should demand a strong course in mechanics, theoretical and practical astronomy, descriptive geometry, and some mathematical physics with a thorough course in experimental physics. To this should be added special courses on surveying and general applications of mathematics that the student may see to what all of the above work is leading. As pedagogical training there should be included a strong course on the teaching of secondary mathematics with observation and practice teaching under expert supervision, a course on the history of mathematics, at least one graduate course on the history and teaching of mathematics, and a course of an encyclopedic nature dealing critically with the field of elementary mathematics from the higher standpoint. A foundation in psychology and the history of education is also necessary. Such a preparation may at first seem excessive, but it is the ideal, and, with the exception of about half of the pedagogic training outlined, it is no more severe than the requirements in France to-day for the secondary teaching license known as the "agrégation." We can demand this if the public will give teaching the recognition it deserves.

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[1] An interesting article on "Practice work in university departments of education," by F. E. Farrington, has recently appeared in the Bulletin of the University of Texas, No. 134, Nov. 1, 1909. It may also be found in the Publications of the National Society of College Teachers of Education for 1909.

SUBCOMMITTEE 2. STATE NORMAL SCHOOLS.

The State normal schools exist for the purpose of training teachers for the public schools. They are generally supported by appropriations by the State legislatures. A small number of these schools are supported by a specified State tax, supplemented by appropriations by the State legislatures, and in a few cases they receive some income from the sale or rental of public-land grants. A few State normal schools have small permanent endowments. Tuition is free, except for slight incidental fees, to persons declaring an intention to teach in the State in which the school is located. With the exception of a few schools in the South the State normal schools are coeducational.

This report is prepared from data obtained from the catalogues of State normal schools, and from the answers to questionnaires. A questionnaire was sent to each of 185 State normal schools and to 8 city training schools. Answers were received from 65 State normal schools and from 3 city training schools. The number of city training schools from which data were received being small, these schools have been classed with the State normal schools.

THE RELATION OF NORMAL SCHOOLS TO OTHER SCHOOLS.

The requirements for entrance to normal schools vary in different parts of the country. Of 64 schools reporting on this topic, 23 per cent require high-school graduation. The majority of these schools are in New England and New York, and offer a two-year course of study, which is composed largely of professional work. The remaining schools require for admission only the completion of the work of the eighth grade. Such schools usually offer two courses of study, a four-year course for the students who have completed only the work of the eighth grade and a two-year course for high-school graduates. A few schools, chiefly in the Middle West, offer two years of work in addition to the above courses, for the completion of which a bachelor's degree is granted.

The work of the normal schools now receives better recognition from the colleges than formerly. Of the schools reporting to this committee 56 per cent receive full credit in the colleges for work done in mathematics, and 20 per cent receive partial credit. Frequently the colleges allow junior-class standing to those graduates of the normal schools who have done two years of work beyond the high school. It is estimated that about 13 per cent of the graduates of the normal schools later pursue advanced work in college. The larger estimates come from the West, where the normal schools are used as preparatory schools by a considerable number of students from the rural districts, because the high schools are not so well developed as those in the East. Since a considerable number of their graduates later go to college, the normal schools of this section have come to offer considerable elective work. It thus becomes possible for the student to do in the normal schools the mathematics usually done in the first two years in college.

Practically all normal-school graduates teach at some time in the public schools. It is estimated that 73 per cent of the graduates teach five years or more. The large majority of them teach in the grades. Sixty-four per cent of the schools report that some of their graduates teach in the high schools in the smaller cities and towns.

THE AIM OF THE INSTRUCTION IN MATHEMATICS.

Each school was asked to give the aim of the instruction in mathematics. Of the schools reporting on this question, 51 per cent claim to pay equal attention to mathematics as a science (the so-called culture value) and to mathematics as an art (the so-called utilitarian value). About 28 per cent claim to emphasize more the culture aspect (except in arithmetic), and 21 per cent put greater stress upon the utilities.

Since a large majority of the students are preparing to teach in the elementary schools, arithmetic is the most important subject in the mathematical curriculum of the normal school. The mathematical instruction has as its chief aim the preparation of efficient teachers of arithmetic. One means used to accomplish this end is to give formal instruction in methods of teaching this subject. Of the schools reporting, 89 per cent give courses in methods of teaching arithmetic and 9 per cent give courses in methods of teaching algebra and geometry. The general opinion is that such courses are distinctly valuable when preceded by a thorough grounding in the subject matter. In 66 per cent of the schools offering these courses they are given wholly, and in 8 per cent in part, by the same teachers that give the academic courses in mathematics.

It is the opinion in 23 per cent of the schools that there should be no difference, except in courses in methods, in the instruction in mathematics offered to students preparing to teach and to other students. The remaining schools take the point of view that in courses for prospective teachers more attention should be paid to the aims in teaching mathematics, to methods of explanation and orderly presentation, and to the historical development and economic importance of the subject.

METHODS OF INSTRUCTION AND BRANCHES OF STUDY.

The courses of study in 64 schools were obtained either from answers to questionnaires or from the catalogues of the schools. The following table shows the different courses given, the number of schools offering each course, and the average number of hours given to each course:

Subject.	Number of schools.	Average number of hours.
Arithmetic	All.	100
Elementary algebra	All.	171
Plane geometry	All.	143
Advanced algebra	9	108
Solid geometry	18	72
Methods of teaching Mathematics	32	63
Plane trigonometry	40	77
Spherical trigonometry	4	80
Analytics	25	96
Calculus	23	87
Theory of equations	3	52
Differential equations	1	48
Surveying	11	57
Analytical mechanics	1	48
History of mathematics	8	70

High-school graduates taking a two-year course in a normal school are required to review arithmetic, and, in some schools, algebra and geometry. Students who enter the normal school from the eighth grade are required to take courses in arithmetic, algebra, and geometry. If more advanced courses in mathematics are offered they are as a rule elective. The number of students electing mathematics is small in most schools, as the only students interested in the higher courses are those who desire to secure advanced standing in college or to teach the subject in a high school. No elective work is offered in 32 per cent of the schools reporting on this question.

Recitations by the students, supplemented by an occasional lecture, is the practically universal method of conducting classes. In nearly all cases a text is used as the basis of a course, the text being supplemented at the pleasure of the instructor.

One of the most important parts of the professional training of a student in a normal school is the practice teaching under supervision. In the schools reporting, 80 is the average number of class periods of practice teaching in mathematics which it is possible for a student to take who is making a specialty of this subject. In 76 per cent of the schools all students are required to do some practice teaching in mathematics, and the average number of class periods required is 54. This teaching is always under the direct supervision of a critic teacher. In 51 per cent of the schools reporting, the head of the department of mathematics is said to exercise some supervision over the practice teaching, but in some of these schools the supervision is very slight. Such supervision seems to the committee to be very desirable in order to unify the work in mathematics throughout the school, to make the work of the training school more efficient, and to keep the teachers of mathematics in the normal school in touch with elementary school work.

Correlation was also made a subject of inquiry. Of the schools reporting, 12 per cent say that no attempt is made to correlate the different mathematical subjects. Thirty-eight per cent are attempting to make some systematic correlation. The remainder attempt some correlation, but nothing systematic. Twelve per cent of the schools reporting on the question think it advisable to eliminate entirely the traditional boundaries between arithmetic, algebra, and geometry; 19 per cent think these boundaries should be eliminated to a large extent; 7 per cent not at all. Other schools suggest methods by which related topics in the different subjects may be correlated.

Sixty-nine per cent of the schools report some attempts at correlating mathematics with other subjects, usually with the sciences, but close correlation is made, probably, in but few schools. The replies to the questionnaire indicate that it is the general opinion that in arithmetic the larger part of the problems in the lower grades and some of the problems in the upper grades should be taken from the other subjects that the pupils are pursuing and from the pupil's environment.

Much more is now being done than ever before in the normal schools in the way of using algebra and geometry, as well as arithmetic, to solve problems taken from the other school subjects and from the experience of the pupils. Some of these problems are taken from texts, which now furnish more problems of this kind than formerly, some are obtained from published lists and from periodicals, and many more are made by the teachers themselves. Some of the teachers in normal schools have been active in arousing interest in genuine applied problems. The great difficulty, as has been often expressed in the replies received by the committee, is to find applied problems that are of real interest to a large number of students.

The question was asked, What causes operate to produce failures in mathematics in normal schools that do not operate in other subjects? About one-fourth of the answers say none. Other answers say that too much time is devoted to other subjects; that we have poor methods of instruction and poor elementary training; that too much is attempted; that the subject, as it has been taught, lacks interest.

The libraries of the normal schools are generally well supplied with works on elementary mathematics, and on the history and teaching of the subject. The departments are also supplied with apparatus necessary for illustrative work in teaching weights and measures, and geometric models for use in teaching mensuration and solid geometry.

EXAMINATIONS.

Thirty-seven per cent of the schools reporting say that examinations are held at the option of the instructor. In such cases the examinations are given at intervals of from 2 to 6 weeks at the completion of important topics. The rule in the remaining schools is to hold examinations at the end of each term or semester. In one school no examinations are given. The examinations are written in 83 per cent of the schools; in the remainder, both written and oral. In 41 per cent of the schools the examination periods are from 40 to 50 minutes; in 46 per cent from 1 to 2 hours; in 13 per cent from 3 to 4 hours.

The principal objects of the examinations are to test the knowledge of the students, to furnish a test of the teaching, to give unity to the subject, and to secure a review. In 5 per cent of the schools the grading of pupils depends entirely upon the examinations, and in 2 per cent not at all. In 20 per cent the examinations count for one-half in determining grades; in 44 per cent for one-third; and in 29 per cent for less than one-third. In 44 per cent of the schools there is a tendency to give less consideration to written examinations given at stated intervals, and in 45 per cent there is a tendency toward abolishing them.

In three States the governing board of the normal schools or the State department of education conducts annual examinations, which in some cases determine promotion and graduation.

MODERN TENDENCIES IN THE TEACHING OF MATHEMATICS.

The committee asked for opinions concerning some recent movements to improve the teaching of elementary mathematics. While it is probable that not all of these recommendations are carried out in the schools from which they come, they are valuable, at least, as indicating present tendencies.

One question asked for recommendations for improving the initial instruction in arithmetic, algebra, and geometry; and a number of recommendations were received. About 18 per cent of the schools recommend that the study of arithmetic be begun later. There should be more objective work, especially in the lower grades, and the work should be less mechanical. There should be drill on the fundamental operations until the pupils have a much higher degree of speed and accuracy than at present.

In teaching algebra, the recommendation comes from almost all schools that this subject be more closely connected with arithmetic, so that the transition from arithmetic to algebra may be simpler and more natural. To accomplish this it is suggested that the literal notation be introduced not later than the seventh grade and used freely in the eighth grade. Furthermore, to make algebra more interesting and useful, let it be used in solving real problems.

In respect to geometry, the answers show a general tendency to make the subject less formal in the beginning. By the use of simple illustrations attempts are made to base the elementary concepts more completely upon the experiences of the pupils. Numerical and other applied problems are used to give the subject more meaning.

Fifty-one schools sent replies to the question "What traditional topics should be omitted from the course of study in arithmetic, algebra, and geometry?" In the case of arithmetic, the general recommendations are to omit all obsolete and purely technical topics and unduly complicated problems. The number of topics which one or more schools recommend for omission is large. Thirteen schools recommend the omission of cube root, except by factoring; 15, the omission of true discount; 9, highest common factor by the Euclidean method; 6, partnership and compound proportion; 5, partial payments and progressions; 4, compound and annual interest, much of percentage, and complicated problems in fractions; 3, bank discount and longitude and time. Other topics are listed for omission by one or more schools. Although a very small per cent of the schools would omit all of the topics just named, the list possesses some interest in that it shows how many of the traditional topics are being removed from the course. There are further suggestions that indicate a somewhat general tendency to abridge the above topics when they are not omitted.

It is generally recommended that the work in algebra be less formal; that we omit or postpone until late in the course complicated multiplications and divisions of polynomials, complicated problems in factoring, fractions, and radicals, and highest common factor by division. The notion of function and of variation should be introduced early. A large number of applied problems should be given throughout the course.

A number of schools recommend that limits, variables, and incommensurables be omitted from elementary geometry. Other schools think these topics should be retained, but that in discussing them only illustrations should be used, and that no proofs should be attempted. In some schools it is thought that with students of the grade of maturity of those in normal schools, it is profitable to discuss the formal proofs of some of the elementary theorems in the above topics. There is general agreement that the proofs of some of the more difficult theorems in plane geometry may be omitted.

Twenty-six per cent of the schools report that some laboratory work is done in mensuration; 15 per cent do field work in trigonometry or surveying; 33 per cent more make some application of the mathematics either in laboratory work or in applied problems. The results from laboratory work are generally thought to be good, but not in all cases.

About 14 per cent of all schools reporting to this committee have made some experiments in teaching mathematics. These were in the main experiments to determine better methods of teaching arithmetic. One of these, for example, was an experiment to determine the efficiency of daily drills in the fundamental operations and to determine the effects of such drills upon the reasoning power. It is encouraging to know that a number of teachers of mathematics in normal schools are undertaking to obtain in a scientific way data concerning improvements in teaching mathematics.

The schools were asked to state what dangers they see, if any, in recent movements to make secondary mathematics more intuitive, useful, and attractive. The answers show a wide range of opinion, as might be expected. Forty-four per cent of the answers say that no danger is seen. Others say that the movements in question have caused inefficient teaching; that drill is neglected; that the disciplinary value of the subject is lost; and that there results superficial and unrelated knowledge.

SUBCOMMITTEE 3. PRIVATE NORMAL SCHOOLS.

The great majority of the private normal schools conduct their own preparatory departments, and hence have no specific entrance requirements. They generally receive students of all grades and fit them for entrance to such courses as they offer. Applicants for advanced standing are usually allowed credit on high-school diplomas or on recommendation from former instructors, though students coming from high schools are very often found deficient in the most elementary parts of mathematics. It is recommended that in the lower schools persistent drills be given in the fundamental operations of arithmetic, so that students may perform these operations not only with facility, but with absolute certainty as to the correctness of their results and may be able to prove the accuracy of their answers.

There seems to be no uniformity whatever in the credits given by the higher institutions of learning for mathematics covered in private normal schools. Each one of these schools stands on its own merits and has its own reputation. The State universities usually give full credit for all the work done in mathematics in the private normal schools of their own State. The comparison of the widely differing reports would seem to indicate that about 30 per cent of the graduates of the private normal schools enter universities and technical schools for the purpose of doing more advanced work, while about 50 per cent of the graduates teach for five years or more, usually in the public schools.

Contrary to the usually accepted opinion, it is probably true that it is not the chief object of the private normal schools to prepare students for teaching. The majority of students later go into business, and a considerable number into technical work. Consequently the utilitarian side of the study of mathematics is probably the phase that is chiefly emphasized. Special courses for students bearing upon the history and teaching of mathematics are rarely, if ever, offered.

Classes are always sustained in arithmetic, the time required of the student depending on his proficiency upon entering the school. From 40 to 60 weeks are usually given to algebra, and very satisfactory courses are generally offered. These often include college algebra. Usually about 36 weeks are given to plane geometry. Many of the schools which offer four-year courses require about six months' work in analytic geometry and perhaps the same time in the study of the calculus, though, not infrequently, the course offered in the latter subject extends throughout an entire year. Very little of the instruction is given in the form of lectures to the class, recitations on the part of the pupils being the well-nigh universal rule.

The recitation periods are very generally one hour in length, five recitations per week. The school year contains from 48 to 50 weeks, without intermission. There appears to be a growing tendency to give frequent tests or examinations. These are usually written and required at various intervals. Some schools give tests as often as once a fortnight, others once a month, and still others not oftener than once in 6 or 10 weeks. Final grades do not usually depend wholly upon result of these tests. Perhaps a weight of about 50 per cent is given to them and about 50 per cent to the record made in class.

SUBCOMMITTEE 4. TEACHERS FOR NORMAL SCHOOLS.

There are about twice as many men as women teaching mathematics in the normal schools of the United States. In the eastern part of the country, however, the women far outnumber the men.

The training of the teachers varies widely. About 60 per cent of the teachers have had high-school training, 55 per cent have had normal-school training, 80 per cent have had college training, and 36 per cent have done graduate work at the universities. The average training for the men is considerably higher than that of the women. There is a marked tendency toward a requirement of graduate work as a prerequisite for teaching mathematics in normal schools. There is also a wide variation in the degrees held by the teachers; about one-third of them have no degree, 42 per cent have the bachelor's degree, 18 per cent the master's degree, and 6 per cent the doctor's degree. The men who hold the higher degrees far outnumber the women.

The term of service in the present teaching position averages about seven and one-half years and is practically the same for men as for women. Twenty-three per cent of all the teachers have served in their present positions for 10 or more years, and 50 per cent have served 5 years or more.

The teachers in the normal schools have not contributed many books or articles to the literature of their field. This may be due, in part, to the fact that most of the teachers meet a large number of classes each week and consequently have neither the time nor the energy necessary for authorship. There is a tendency to lighten the work of the teacher in the normal schools, and this may result in a more productive scholarship from this source. Practically all of the contributions made up to the present time have been by the men.

None of the schools make a practice of employing their undergraduates as instructors, and only a few of the schools so employ their graduates without further training.

Most of the teachers of mathematics would prescribe work through the calculus as the minimum academic preparation for teachers of mathematics in normal schools. About 15 per cent of the teachers would include more advanced courses as the minimum preparation.

A large per cent of the teachers express the opinion that in addition to the academic training the prospective teacher of mathematics should also be required to take a professional course, including psychology, history of education, school management, and special methods in the courses that he is to teach.

About 30 per cent of the teachers express the belief that an experience of from one to five years in elementary and secondary schools should be a prerequisite for normal-school teaching.

Most of the normal schools of the United States were established primarily to prepare teachers for the work of the elementary schools, and the various subjects of the curriculum were determined largely by this ideal. Graduate work was not a prerequisite for the normal-school teacher, for his margin of knowledge was usually sufficient if he had completed the undergraduate work at a reputable college. In recent years, however, the normal schools are sending an increasingly large number of their graduates into positions in the secondary schools. Some schools in the Central West send almost half of their graduates into such positions.

This extension of the functions of the normal school has necessitated an extension of the curriculum into the more advanced subjects. A few years ago no mathematics was offered in the normal schools beyond solid geometry and trigonometry. To-day analytics and calculus are offered in several of the best schools, and there is a marked tendency to offer these advanced subjects in most of the schools. These subjects are now offered in order that the prospective teacher of mathematics may have a broader view of the subject and a proper perspective for teaching mathematics in the secondary schools.

The extension of the curriculum into the more advanced subjects means that the teachers of mathematics in the normal schools must be selected from those who have done graduate work in mathematics. Forty-five per cent of the men and 18 per cent of the women now teaching mathematics in the normal schools have completed at least one year of graduate work in the subject, and there is a marked tendency in this country to require at least a year of graduate work from all prospective teachers. A year of graduate work will be required, not because of the degree that may thereby be secured, but because of the amount of work that it represents, and because of the better basis that it gives for a rational presentation of the subject to those who are to become teachers.

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MATHEMATICS IN THE ELEMENTARY SCHOOLS OF THE UNITED STATES

INTERNATIONAL COMMISSION ON THE TEACHING OF MATHEMATICS

THE AMERICAN REPORT

COMMITTEES I AND II

DEPARTMENT OF THE INTERIOR

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1911

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MATHEMATICS IN THE ELEMENTARY SCHOOLS OF THE UNITED STATES.

SUBCOMMITTEE 1. SCHEMATIC SURVEY OF AMERICAN EDUCATIONAL INSTITUTIONS—THEIR SEQUENCE AND INTERRELATIONS.

The following report of Subcommittee I was prepared to meet the special needs of foreign readers. Although it does not relate solely to elementary schools, it forms an appropriate introduction to the general report of Committee No. I, since some schematic survey of our educational institutions is necessary in beginning the study of our system. For this reason it precedes the general report of this committee.

GENERAL DIVISIONS.

The American system of education divides into two main divisions:

A. Public education: Government controlled and Government supported.

B. Nonpublic education: Controlled by religious bodies, private corporations, or persons with philanthropic or fiduciary intent. May be subdivided into: (*a*) Religious education, controlled and supported by religious denominations and sects; (*b*) private and semiprivate institutions, including those managed for profit; and (*c*) supplementary and extra institutionalized agencies, such as the Carnegie foundation for the promotion of teaching, the Russell Sage foundation, and the National Education Association.

AGENCIES OF PUBLIC EDUCATION.

I. The National Government. This administers but a small portion of public education. (*a*) The Bureau of Education is a national office, under the Department of the Interior. It is designed mainly to assemble, digest, and disseminate educational information. It is also charged with certain responsibilities for native education (in Alaska). (*b*) The Indians of the United States are mostly wards of the Nation. As such they are educated by the National Government, either through subsidies granted to church bodies or through schools maintained by the Department of the Interior. These schools partake of an industrial character. (*c*) The National Government also organizes or provides for the organization of the school systems for its dependencies, such as Porto Rico and the Philippines. Similarly it provides for the school system of the Capital City—Washington. (*d*) Two principal schools—West Point and Annapolis—and a number of minor schools are maintained for the training of officers and men for the Army and Navy. (*c*) The National Government makes appropriations to each of the States for the furtherance of higher education in agriculture and the mechanic arts. It has also in the past provided extensive land grants for the support of the public-school systems of the States and universities. In conjunction with the States, or sometimes philanthropic agencies, it carries on investigation and experimental work in agriculture for educational purposes.

II. The State governments. The primary agency for the exercise of educational functions is the State. The National Government exercises no control and so far little power of suggestion over State governments.

(a) State constitutions. These, as fundamental laws, usually contain provisions requiring the organization of systems of public education, and often defining special features.

(b) State legislatures. These, meeting usually annually or biennially, pass laws fixing, often in great detail, forms of educational administration, providing for support and the like.

(c) State board and State superintendent. Nearly all States have provisions for a State machinery of educational administration, the scope and authority of which vary greatly. In general, this administration is confined to elementary and secondary education. In many cases the State superintendent is elected by general suffrage, and his functions are mainly supervisory and advisory. In other cases he is an educational expert, appointed by a State board, and with considerable authority for imposing standards and administering types of education. State boards also vary widely in functions. Some have authority to select a variety of educational experts, to direct the expenditure of funds, and to control certain types of education. Others have functions limited to custody of State school funds and the certification of teachers.

(d) State educational institutions. The State forms the area for the administration of a variety of educational institutions. 1. Universities and colleges. Most Western and Southern States support and control universities; and all have an agricultural college, partly supported by national grants. Frequently these are directed by special boards appointed by the State executive. 2. Normal schools are found in all but two States, governed either by a State board or by local boards appointed for this purpose by the executive or by a combination of both authorities. 3. Schools for delinquents, defectives, and dependents. Almost everywhere most of these are State institutions; but sometimes the State supports and leaves control to a religious or philanthropic body. 4. Special schools, especially for agricultural, forestry, or technical training, maintained as State institutions, are found in a few States. 5. In some States a library commission is maintained as part of the State educational machinery.

(e) Teachers' institutes. State libraries for teachers and extension work are in some cases organized and supported by State authorities, but more commonly by smaller areas than the State.

(f) In a few States, State authorities certificate teachers, inspect schools (especially secondary schools), select textbooks, approve plans for buildings, examine pupils (especially for admission to secondary school or college), and provide or suggest courses of study. Such functions are found in relatively few States, but there is a growing tendency in this direction.

III. Local areas of administration of education. These vary in size and political importance in the various States. Five types are commonly found:

(a) The county, the largest subdivision of the State, under the law exercises little or no educational function in New England, much in most Southern States, and a varying amount in North Central and Western States. Is of considerable importance as an authority for inspection (commonly miscalled supervision), auditing of educational accounts, certification, after training of teachers, and of taxation. Less frequently it is the administrative unit for secondary agricultural education; occasionally for general secondary education.

(b) The town or township. Usually embraces several schools and is frequently the area of local administration and taxation in all that pertains directly to secondary and elementary schools.

(c) The district. Originally the area from which one school drew its pupils. In early stages of the evolution of educational administration it had important functions, apart from the direct management of schools. These functions are gradually being transferred to larger areas. They are the consolidation of districts, and the transportation of pupils. In many States large central schools are being formed.

(d) The city. Municipal areas give rise to districts with special characteristics. The city frequently combines the administrative functions exercised by county, town, and district, and in some cases the State even relaxes its supervision in the case of city districts. Within the cities of the United States educational administration tends to become centralized, lay boards becoming smaller, the authority of educational experts greater.

(e) In a few States special administrative ways exist. In Massachusetts a union of towns forms a supervisory district; in New York the school commissioner district differs from the county; in Virginia the State is divided into a few large areas for certain kinds of supervision.

TYPES OF PUBLIC SCHOOLS.

I. The kindergarten, usually admitting pupils from 3 to 5 years of age, and seldom holding them beyond 6. Found mainly in cities, and most commonly provided in poorer sections. In 1907-8 all cities having 8,000 or more population reported their kindergartens as containing—157,900 pupils. Nowhere is kindergarten training prerequisite to entrance to the elementary school.

II. The elementary school. This term is now commonly applied to the types of schools formerly designated as primary, intermediate, and grammar or grammar grades. The course is nearly always 8 years in length, very rarely 7, occasionally 9 or 10. The completion of the elementary course is necessary for entrance to the high schools, and the elementary school rarely provides work paralleling that of the secondary school, this providing the marked contrast to European practice. In a few cases it is attempted to teach secondary subjects, such as foreign language and mathematics, in the upper grades of the elementary school. Under present conditions the standard maintained by the elementary school is such that seldom more than half of all children are able to finish it by the close of the compulsory school period—14 years of age. In 1907-8 some 16,100,000 children were reported in the elementary schools.

III. Secondary schools under public support are commonly called high schools. Of these there are four or more distinguishable types: (*a*) General high schools, sometimes subdivided as classical, literary, scientific, etc., whose aim is primarily cultural, and whose curricula are mainly composed of languages, mathematics, science, and history. (*b*) Commercial high schools, sometimes within general high schools. These vary largely in character, some having short courses, other substantial four-year programs, whose controlling aim is preparation for commercial vocations. (*c*) Technical high schools, variously called manual training, mechanic arts, and polytechnic high schools, which aim to include with parts of a general course a considerable training in the technical subjects which attach to the industrial arts or household arts. (*d*) Agricultural high schools. These vary largely in curricula, some being ordinary high schools with attempts at agricultural training, others centering mainly around studies of agriculture.

In 1907–8 there were in the public high schools of the United States 790,000 students, or about 0.92 per cent of the total population; of these nearly 60 per cent were girls. Very few of these students were under 14 years of age, and also few were over 19. As contrasted with European secondary schools, the most significant fact is the late age at which pupils may take up secondary school work, it being obligatory to complete the elementary course first. About one-half the pupils entering high school do not stay more than two years, or beyond the age of 16. Of the above number of students, 59,000 were reported in commercial departments. No separate statistics are available of attendance in public technical secondary schools, but in 1907–8 there were in the public and private schools of this type 58,000 students.

IV. Normal schools, designed primarily for the training of teachers for elementary schools, are found in all but four States, where courses at State colleges are provided. In 1907–8 there were 189 of these State normal schools, with 64,000 students. Two types are distinguishable: Those receiving only high-school graduates, and usually having a course two years in length, and those receiving pupils with little more than elementary school preparation, and having courses from three to five (usually four) years in length. Sometimes both kinds of courses are found in the same school. The States better supplied with secondary schools now usually require high-school graduation for admission.

Many of the larger cities of the United States also maintain city training schools which receive high-school graduates and give them a one or two years' course in preparation for work in the elementary schools of the respective cities.

A number of normal schools, in addition to their two-year courses for high-school graduates, also maintain four-year courses for exceptional students, and give degrees. At least one (Albany Normal College, New York) aims primarily to prepare teachers for secondary schools. But a large and increasing majority of the teachers in secondary schools must be graduates of the regular colleges and universities.

Normal schools are frequently resorted to by young people whose primary aim is a liberal education, rather than a preparation for teaching.

V. Colleges and universities. Satisfactory statistics of public as distinguished from private colleges and universities do not exist. In 1907–8, of the 573 universities, colleges, and technological schools having 150,000 students, it was reported that 89 having over 60,000 students were public—that is, were supported mainly at public expense and were governed by public bodies; 62 of these were State universities or colleges of agriculture. The attendance at these institutions averages much higher than at private schools. Usually their admission requirements coincide with the requirements for graduation from local secondary schools, thus forming part in a continuous chain of public education.

Affiliated with, or integrated with, many of the public universities are professional colleges for medicine, law, pharmacy, and the like. Within recent years there are also appearing special colleges as parts of the universities for the training of teachers, especially those for secondary schools, and those preparing for administrative work.

VI. Special schools. These exist to meet special class or social needs, and have their standards governed by the conditions to which they must adapt themselves.

(*a*) Under the National Government are two schools primarily to train officers for the Army and Navy. These are of collegiate or technological rank, and receive students of selected qualities. In addition, the Government maintains extension or graduate study for officers in service and a number of schools for the training of cadets or newly enlisted men for the Navy.

(*b*) Indian education is also under the direction of the National Government. Schools are maintained in Alaska, on the reservations in the United States, and in a number of cases off the reservations, for pupils especially of a more advanced type. The work in these schools is usually elementary in character, with increasing attention to practical or vocational aspects. In a few schools (Hampton, Haskell) special attention is given to the training of teachers, and especially for the transmission of the household arts and suitable vocations for men.

(*c*) Originally, in most of the States, philanthropy supported the education of some defectives, dependents, and delinquents. Then the States subsidized these institutions and later in many cases either took them over or supplanted them with public schools of day or institutional type. Some are under the State administrative machinery, others under local control and support, but these distinctions are unimportant. Each type of school works out courses of instruction and methods adapted to its needs. The work is increasingly vocational in character. In 1907–8 there were 40 State schools for the blind, with 4,340 pupils; 122 schools for the deaf (55 State, 51 public day schools, and 16 private), with 10,042 students in the State schools; and 25 State institutions of school character for the feeble-minded, with 17,225 inmates. In the same year 92 reform schools reported 36,900 pupils, nearly all from 12 to 16 years of age. The care of dependents is mostly under private auspices, and no satisfactory statistics are extant of the number of schools.

(*d*) Several States have established special forms of industrial schools, sometimes of secondary grade, sometimes intermediate between secondary school and college. There are no available statistics of these. As a rule their curricula approximate in character the technical secondary schools, with specially intensive developments along the lines of agriculture, industrial arts, and household arts.

(*e*) Continuation schools, evening schools. These are extensively developed in the larger cities of the United States. In 1905–6, 23 cities reported 314,000 children enrolled and 129,000 in average daily attendance. No satisfactory classification exists showing number who are taking technical work, high-school work, studies of an elementary nature, or special work in English for foreigners. All these

> types are represented. It is generally known that special classes for the teaching of English to foreigners are largely on the increase and that technical classes are being steadily developed. But it is rare to find consistent programs running through a series of years—the work is fragmentary.

A form of educational work growing out of the universities is that called university extension. By means of lectures and extension classes it seeks to disseminate and popularize higher education.

NONPUBLIC AGENCIES OF EDUCATION.

I. Religious organizations. A very large part of private education in the United States from the lowest to the highest grade is carried on by religious organizations. With very few exceptions (in the case of schools for dependents, delinquents, and defectives) these schools receive no public aid; and those not receiving public aid are only rarely under public supervision, and that of the most perfunctory character. No system of certification prevails with regard to teachers in these schools; and they develop their own standards according to their own needs. Except for colleges and some forms of secondary education, it is not possible to procure statistics. In general it is true that the competition of the public schools tends to cause these private institutions to endeavor not to fall too far behind in the quality of their teaching. In these schools, especially those under the Roman Catholic Church, many of the teachers give their services as part of their religious duty, and where teachers work for pay, that is very low. As a rule, these schools are not experimental, but aim deliberately to parallel and if possible to fill the place of the public schools for certain classes of children.

II. Philanthropic organizations. These not infrequently grow out of church influences, but also quite commonly have no direct religious connection. On the whole they tend to develop types of education with which the system of public schools does not at present concern itself. These led the way in establishing higher education, in endeavoring to educate the defective, the delinquent, and the neglected; in establishing vocational education; and in developing the wider adaptations of education in vacation school, playground vocation bureaus, and so on. Consequently the schools under direction of nonreligious philanthropic agencies tend to be experimental, and their standards change, and the results of their work do not lend themselves to statistical treatment.

III. Commercial ventures. Some forms of education in the United States represent efforts for private profit. The types of school resulting vary largely in character and quality. Private secondary education usually caters to the wealthier classes of the community, especially in providing schools that combine residence and instruction. These schools have not State supervision, but tend, by virtue of their clientage, to be of excellent quality. Many of them have as their controlling function the fitting of students for college. Another type is that fitting for certain portions of commercial practice. These vary enormously, some being of excellent quality, others giving short courses and relying largely on advertising to win students. Of similar quality are a number of private normal schools, which aim to prepare students for teachers' examinations. Correspondence schools are private ventures, sometimes giving good work under adverse conditions, sometimes preying upon the credulity of young workingmen. A few private schools for industrial arts (trade schools) exist, but play a small part in vocational education.

The large majority of colleges and universities are private, and frequently originated under the auspices of some religious organization; but these are tending away from any form of religious control, and fall into the group described above as philanthropic, since only a small part of their actual expenses are usually derived from the fees of students.

Over private educational agencies of all sorts there is almost no State control, except in the case of those that deal with delinquent or afflicted children. True to the prevalent individualism of America, it is assumed by the State that the demands of those who patronize the private schools and the competition of those under public management is sufficient to insure the quality of the work of the former. In New York and Connecticut there are certain beginnings of State supervision, but they are not yet significant, except in the particular respect that scholarship standards in secondary education are made largely the same in New York State for both public and private schools by a system of examinations conducted by public authorities. But in such matters as certification of teachers, standards of attendance, equipment, and methods of teaching there exists no form of public control.

The exceptions are found in those institutions which care for destitute, defective, and delinquent children, and here State supervision is exercised primarily because these institutions receive considerable public aid. Those philanthropic institutions that do not obtain public assistance have little or no public inspection.

TYPES OF NONPUBLIC SCHOOLS.

These usually parallel the types of public school given above, except as regards special features, like the boarding life of the private secondary school, the short courses of the business school, and the religious education found in the schools under religious organizations.

I. Kindergartens. Almost always philanthropic and frequently contributing some training of teachers.

II. Parochial elementary schools. These are mainly developed under the Lutheran and Roman Catholic Churches, and usually parallel the public schools. In the Catholic schools the supervision is under the parish priest, and the teachers are often members of orders.

III. Private elementary schools maintained for profit are few and have small influence.

IV. Private business schools are conducted chiefly for profit. Over 150,000 students attended such schools in 1906–7. Admission requirements and quality of work vary enormously and generally tend to be strictly practical, i. e., produce in a short time the maximum of vocational efficiency.

V. Private trade schools. These are not numerous and vary greatly in character. A few are maintained by industries to assist apprentices, in which case the work is usually technical, to supplement shop work. In other cases schools maintained for profit give short and intensive training in certain trades (commonly woodworking, plumbing, machine-shop work, and so on). Several schools endowed by philanthropy give long courses of trade training.

VI. Correspondence schools. These probably have over a hundred thousand students in the United States (no exact figures available) to whom they teach mathematics, drawing, applied science, especially mechanics, and in less degree a few other subjects. Standards are variable; much of the work plays upon credulity, but under favorable conditions the more self-reliant students gain much. They exist mainly for profit.

VII. Parochial secondary education. This is yet little developed. Secondary education for religious bodies is accomplished mainly in academies and preparatory departments of denominational colleges.

VIII. Private secondary schools. These are numerous and strong. They fill two chief functions, sometimes not closely related. They serve as boarding schools at the adolescent period when many parents believe that boarding-school life is very valuable for their children; and they serve to prepare pupils directly for college. They grow but slowly, but have a fairly constant attendance of over 150,000 pupils. Many of them have endowed foundations.

IX. Colleges and universities. These seldom exist for profit, usually owing their foundation to religious or philanthropic zeal. In recent years religious control has greatly relaxed, so that it was easily possible for many of them to change some nominal restrictions in their organization and come under the definitions imposed by the Carnegie Foundation for the Advancement of Teaching.

In 1907–8 there were reported to the Commissioner of Education 484 private universities, colleges, and schools of technology, with enrollment of over 96,000 students. While a secondary education is assumed as prerequisite for admission, it is known that standards vary widely among these private institutions of higher learning.

Professional schools, often parts of universities but also in many cases independent, are, apart from those devoted to engineering pursuits, of six kinds—theological (9,500 students), law (18,000 students), medical (22,000 students), dental (6,500 students), pharmaceutical (5,500 students), and veterinary (2,200 students).

X. Special schools. A variety of special schools not included above exist under private leadership. The education of negroes, of immigrants, and of defectives has produced schools adapted to meet particular ends. Frequently these serve society as experimental stations, pointing the way to subsequent State action. Their character and purposes are too varied to admit of statistical treatment.

COMMITTEE NO. I. GENERAL ELEMENTARY SCHOOLS.

The special field of investigation assigned to this committee was the teaching of mathematics in both public and private schools of the rank known as elementary schools. It was desired that while the investigation should cover whatever ground seemed pertinent, it should especially consider the following topics:

(*a*) The aim and organization of the schools and the general relation of each type of school to the others; (*b*) the mathematical curriculum in other schools; (*c*) the question of examinations from the point of view of the schools; (*d*) the methods employed in teaching in the schools; (*e*) the preparation of teachers for the schools. It was desired that the report should particularly set forth the present conditions and tendencies. An attempt has been made to carry out the spirit of these directions. The report is organized with reference to these five points.

I. THE AIM AND ORGANIZATION OF THE ELEMENTARY SCHOOLS.

DEFINITION AND AIM OF ELEMENTARY EDUCATION.

Elementary education is that training which by common custom is deemed desirable and necessary for the duties and privileges of citizenship. It is usually made compulsory by law. Like all such definitions, the meaning of this statement becomes clear only through an examination of its interpretation as given in the curricula of the various school systems or in somewhat more specific statements of its content by various individuals. The elementary school strives to give the pupil control over the tools for the acquisition of knowledge, to develop interests and desires for further acquisition of knowledge, to excite a large number of curiosities, to stimulate thinking, to form the habit of collecting facts with which to think, and to aid the pupil in the formation of right habits of conduct. Prof. Thorndike has said:

> The special proximate aims of the first six years of school life are commonly taken to be to give physical training and protection against disease; knowledge of the simple facts of nature and human life; the ability to gain knowledge and pleasure through reading, and to express ideas and feelings through spoken and written language, music, and other arts; interest in the concrete life of the world; habits of intelligent curiosity; purpose in thinking, modesty, obedience, honesty, helpfulness, affection, courage, and justice, and the ideals proper to child life.

Prof. Hanus has said:

> Elementary, or presecondary school education, should provide the most salutary physical environment for the pupil, and promote his normal physical development through appropriate training. It should open the mind of the child and let the world in. It should stimulate and gratify curiosity in every field of worthy human activity, and utilize this curiosity for the acquisition of knowledge and the development of incipient permanent interests in and power over this knowledge. It should acquaint the pupil with his duties and his privileges as a temporarily dependent member of society, and promote the development of habits of thought and conduct in harmony with his growing insight.

ELEMENTARY SCHOOLS.

Different localities have interpreted this definition as seems proper to them, and in accord with the interpretation they have organized their elementary schools. In the Eastern States these schools often include the first nine school years or grades; in the South, usually seven years; in the North and West usually eight years. There is a movement urged by some of the best educators to have the elementary grades cover the first six school years, from the age of 6 to the age of 12, letting the secondary school cover the next six school years.

The school year consists of approximately 180 school days per year. In 1890 the average in cities of from 4,000 to 8,000 population was 180.9 days, and for the whole country 151 days. The school day is approximately five hours in length, and the school is in session from Monday to Friday, inclusive.

II. THE CURRICULUM IN MATHEMATICS IN THE ELEMENTARY SCHOOLS.

CURRICULUM IN GENERAL.

The term "arithmetic" is used to denote the mathematical element of the curriculum in American elementary schools. Arithmetic is taught in all of the schools. It may safely be said that the public at large consider it one of the most important subjects of the curriculum, and circumstances have given it in the past an unusually prominent place in the estimation of teachers. Mathematics was formerly, and is to-day, an excellent test of the general alertness and "brightness" of the pupils. As a result the "bright" pupils, who later become the teachers, continued to give emphasis to the subject. Furthermore, the organization of the rural school with its one teacher in charge of many classes necessitated much seat work, and since assignments in mathematics could readily be made and could be corrected very easily, while to have "ciphered through the book" was a mark of distinction, and since pupils who had any ambition to attain this distinction could thus be kept "in order" for long periods, mathematics came to form a major part of the curriculum in the rural school, and it has maintained its position to an extent up to the present. There is a disposition in school circles to deny that the importance of mathematical training is such as to warrant the place it has occupied and still holds.

A study of the time devoted to various subjects in the grades in 50 of the leading cities showed that about 15.26 per cent of all of the school time was devoted to arithmetic. The same study indicated certain other facts bearing upon the place of mathematics in the curriculum. It showed that arithmetic as a formal study is being dropped out of the first and second grades and that in the upper grades arithmetic is being supplemented by algebra and geometry. Out of these 50 large school systems 19 only have algebra as such in the seventh or eighth grades and only 3 give any time or attention to geometry other than the work in mensuration. Recommendations have appeared from time to time during the past 15 years that the arithmetic course be curtailed and enriched—curtailed by omitting the study in the early grades and by omitting certain topics; enriched by introducing geometry, algebra, and other interesting topics in the upper grades. The statistics quoted above indicate that only 38 per cent of the 50 largest cities have followed out the recommendation. This same condition was found by another entirely independent investigation, except that even a smaller proportion of the schools were giving attention to algebra. So, in general, mathematics in American schools means particularly arithmetic with a certain amount of mensuration.

CONDUCT OF THE MATHEMATICS COURSE.

The teachers follow rather closely the textbook which has been provided for the schools. Whether following the text or independent of it, they are guided as to the extent of each year's work by an outline or course of study. The course of study is usually made out by the superintendent of schools of the city; in larger cities the superintendent delegates this work either to assistants or to a committee of principals or of principals and teachers, while occasionally the head of the department of mathematics in the high school is called upon to assist. The supervising officers of the schools are as a rule expert, experienced men and women, who have "risen to the top" because of their ability, and they bring to their work on the courses of study the product of their years of experience. While this is true, it is natural to inquire whether it is common to have in large systems an expert supervisor of mathematics, analogous to the supervisors of music and art. An investigation has shown that it is exceedingly rare for cities to employ such a supervisor of mathematics, although in some cases the work is delegated to an assistant superintendent. The same condition obtains in the case of geography, history, and other subjects. At the same time mathematics undoubtedly is a subject which calls for expert knowledge which is less commonly part of the equipment of all teachers; and, furthermore, it is a subject in the teaching of which there is to-day an unusual amount of change and uncertainty. It must be said that there are in all systems of schools a growing number of teachers who have made a special study of the teaching of mathematics in schools of education. The committee feels that expert supervision of arithmetic in the public schools should be more common.

COURSE OF STUDY.

The course of study in its simplest form consists merely of directions as to the page limits within the text, thus marking the assignment for each year. It varies from this to a much more detailed outline in communities where there is dissatisfaction with the general type of text. In these latter places there is given an outline by grades of the topics to be covered, together with teaching helps, references, and suggestions for problem material. In such cases it is generally understood that the outline rather than the text is to be followed. The wisdom of this plan depends upon the amount and character of the supervision, and upon the ability of the teaching force.

CONTENT OF THE CURRICULUM IN MATHEMATICS.

The following summary indicates the general content of the courses by grades:

Grade 1.—More or less incidental number work or number work correlated with manual training or with some other definite subject. Variations: From no number work at all to very formal work on addition, subtraction, and the multiplication tables.

Grade 2.—Number work correlated with other subjects. Addition facts emphasized and in many places the multiplication table begun. Variations: In a few schools there is no number work; in some, at the other extreme, division is taught.

Grade 3.—The processes of addition and subtraction mastered together with some work on the multiplication tables, the tables often being completed. Variations: A few schools give no work at all, while some give considerable work in fractions.

Grade 4.—Multiplication and division mastered. Variations: Fractions are taken up in many schools.

Grade 5.—Fractions mastered, some decimals introduced, denominate numbers employed.

Grade 6.—Decimals as related to common fractions, with much problem work. In some schools simple interest and percentage are begun.

Grade 7.—Percentage and some of its applications.

Grade 8.—Business applications of percentage. Mensuration of solids. Variations: No arithmetic at all in the whole or the latter half of the grade; the time devoted to algebra; algebra combined with arithmetic.

This general information above set forth is here represented in graphic form. In this form an opportunity is given to see when the study of certain topics is commenced, where the bulk of it is done, and where it is completed. This graphic presentation of the facts is based upon an investigation made of the courses of study in 28 typical cities. Aside from the subjects taught in all of the schools, it is interesting to note that compound interest is taught in 64 per cent of the schools, partial payments in 60 per cent, exchange in 43 per cent, partnership in 57 per cent, stocks and bonds in 71 per cent, compound proportion in 43 per cent, cube root in 28 per cent, the metric system in 36 per cent, algebra in 36 per cent, constructional geometry in 28 per cent, and graphical work in 7 per cent.

While it is understood that the number of school courses carefully examined was very small, these results indicate certain facts. First, certain subjects, namely, certain of those mentioned in the preceding paragraph, are slowly being dropped from the course, or else, in the case of the last four, are very slowly entering the course; second, in view of the fact that the courses examined were from larger cities, so that these results represent conditions above the average, it is evident that such subjects as cube root, partnership, exchange, compound proportion, and partial payments, are not being dropped as rapidly as they should be, while the other topics are not being introduced as rapidly as some discussions might lead us to think they are, regardless of whether they should be or not.

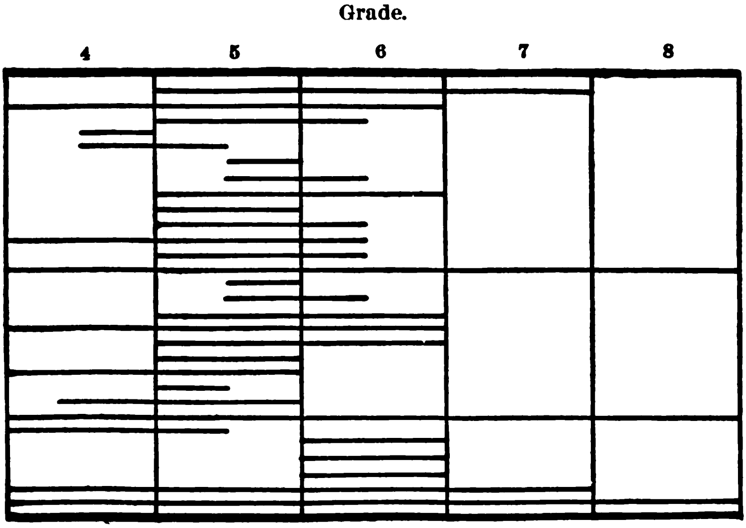

Fig. 1.—Grades in which common fractions are given; taught in all schools; most commonly emphasized in grade 5.

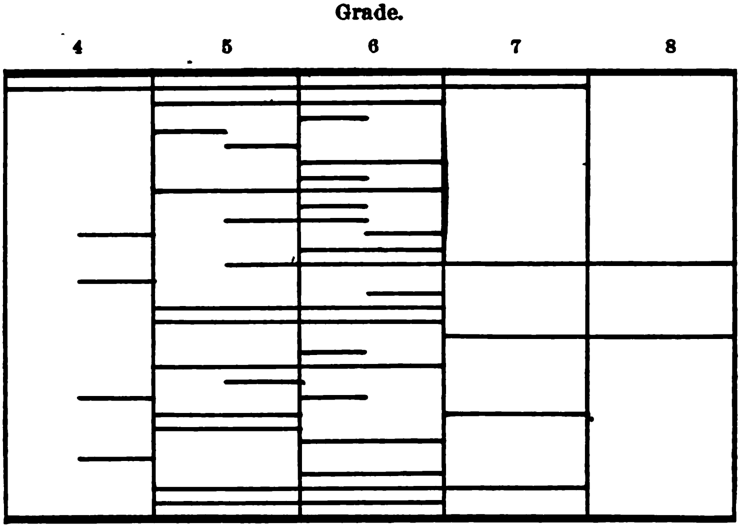

FIG. 2.—Grades in which decimals are given; taught in all schools; most commonly emphasized in grade 6.

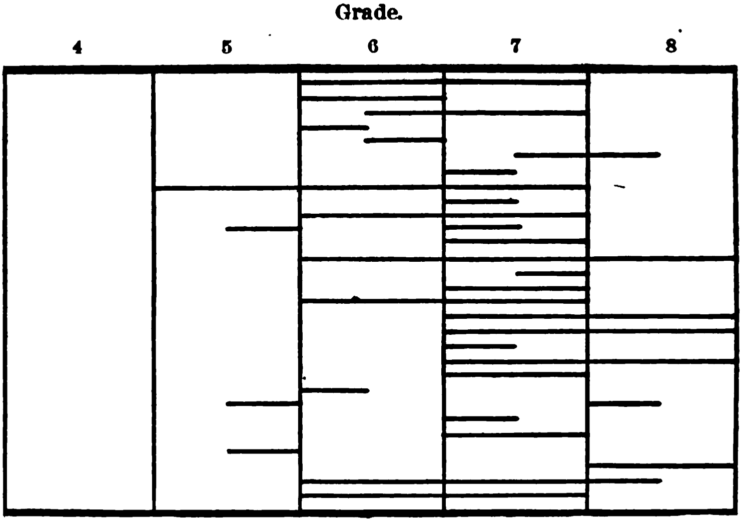

FIG. 3.—Grades in which percentage is given; taught in all schools; most commonly emphasized in grade 7.

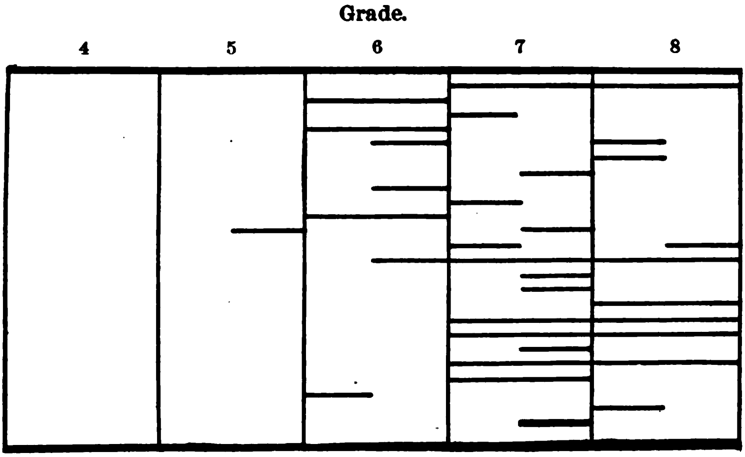

FIG. 4.—Grades in which simple interest is given; taught in all schools; most commonly emphasized in grade 7.

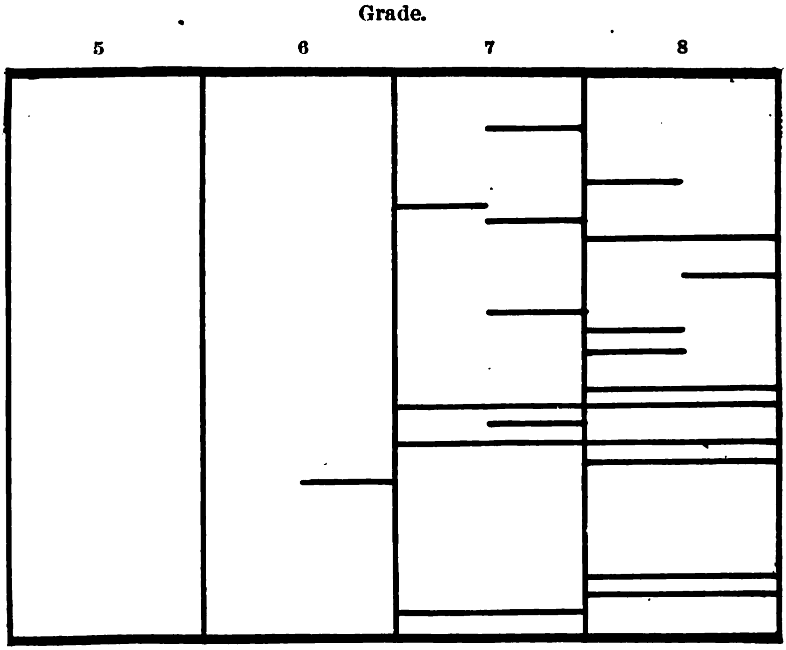

FIG. 5.—Compound interest; taught in eighteen out of twenty-eight schools, or 64.2 per cent of them; most commonly emphasized in grade 8.

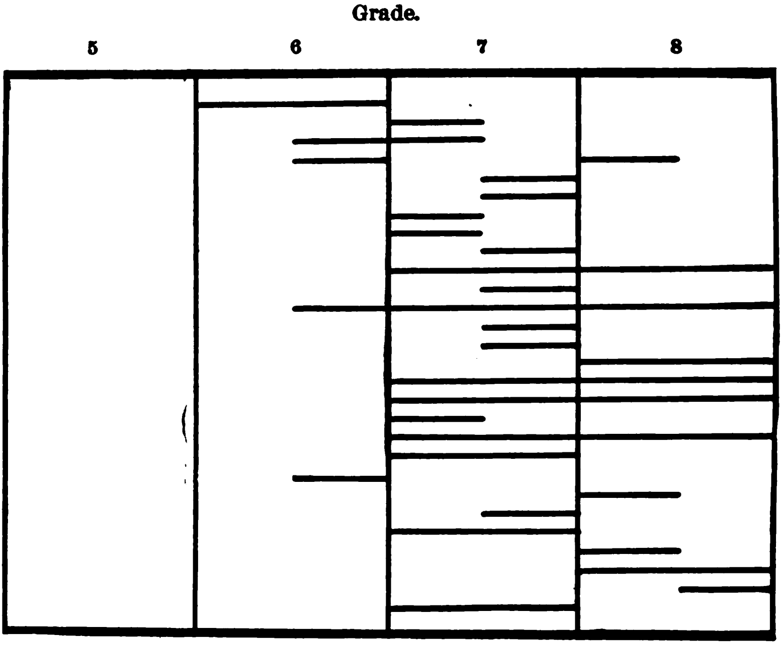

FIG. 6.—Commission; taught in most schools; most commonly emphasized in grade 7.

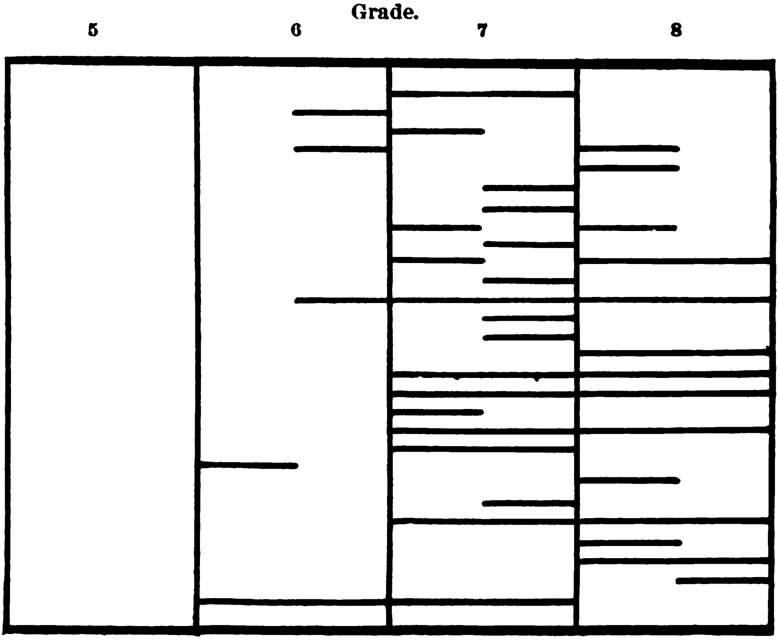

FIG. 7.—Commercial discount; taught in most schools; most commonly emphasized in grade 7 or 8.

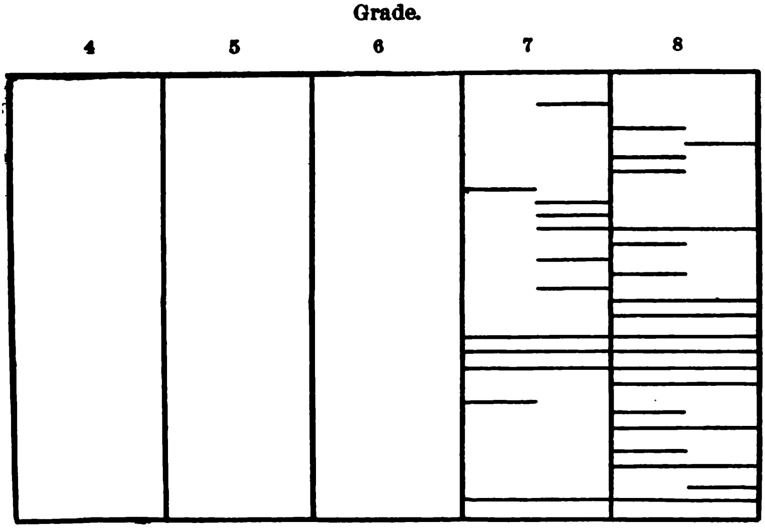

FIG. 8.—Bank discount; taught in most schools; most commonly emphasized in grade 8.

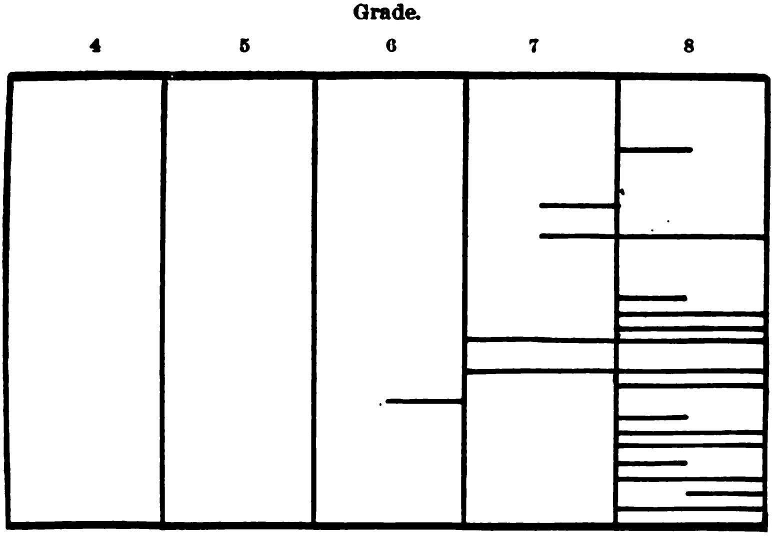

FIG. 9.—Partial payments; taught in 60.7 per cent of the twenty-eight schools; most commonly emphasized in grade 8.

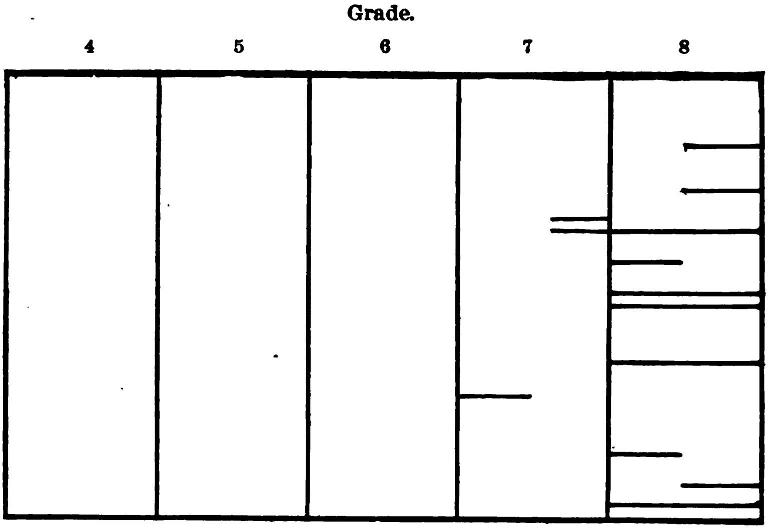

FIG. 10.—Exchange; taught in 42.8 per cent of the twenty-eight schools; most commonly emphasized in grade 8.

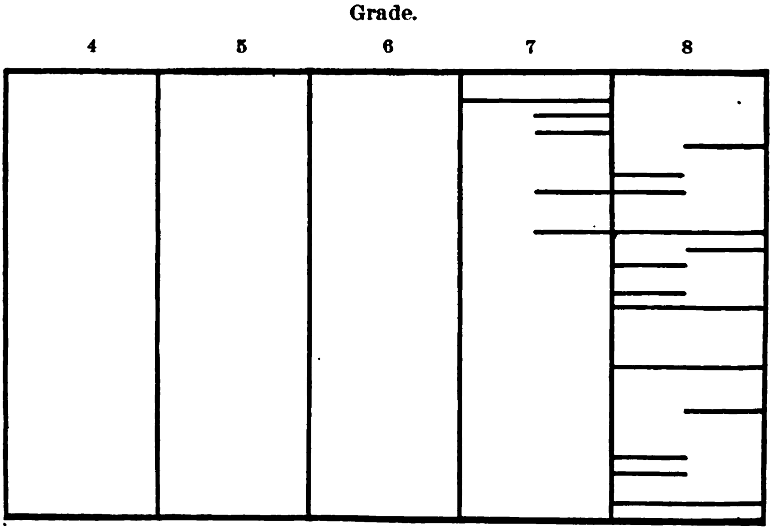

FIG. 11.—Partnership; taught in 57.1 per cent of the twenty-eight schools; most commonly emphasized in grade 8.

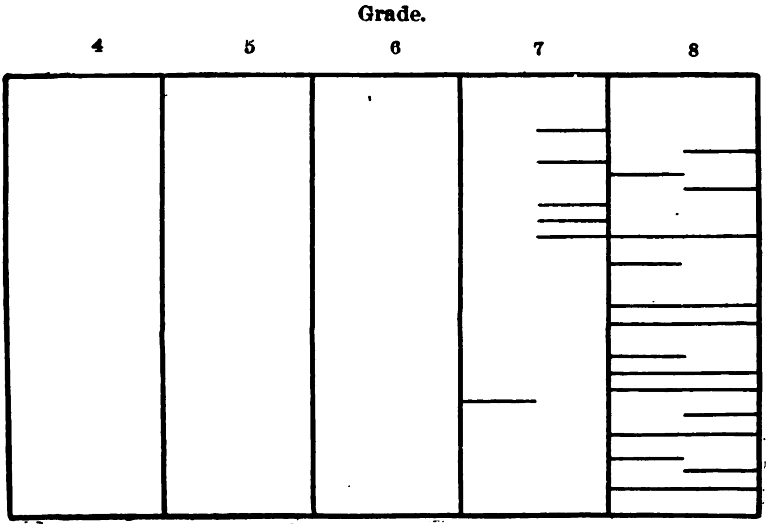

FIG. 12.—Stocks and bonds; taught in 71.4 per cent of the twenty-eight schools; most commonly emphasized in grade 8.

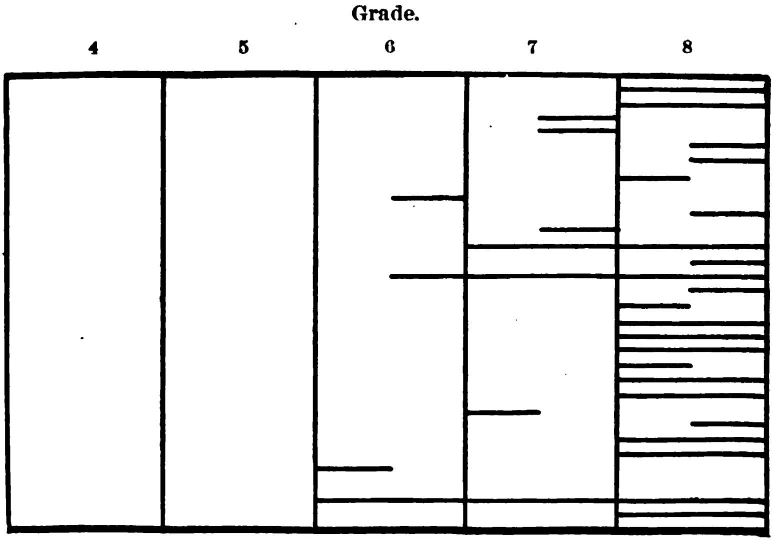

FIG. 13.—Simple proportion; taught in most schools; most commonly emphasized in grade 8.

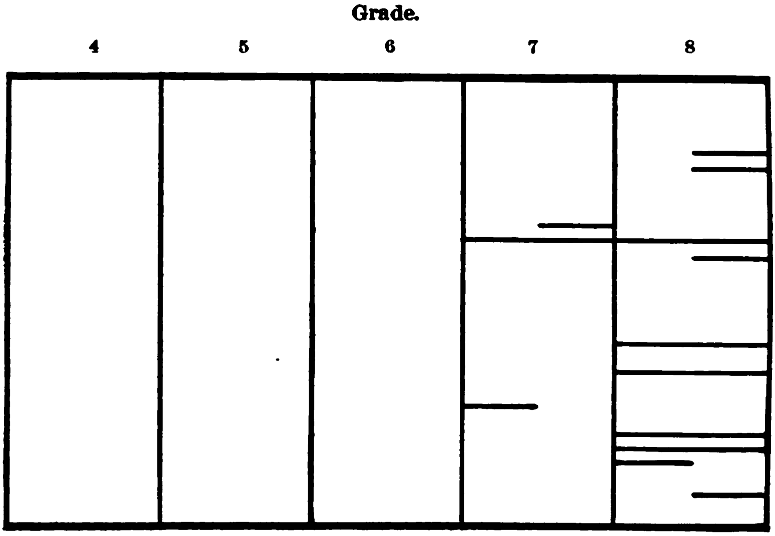

Fig. 14.—Compound proportion; taught in 42.8 per cent of the twenty-eight schools; most commonly emphasized in grade 8.

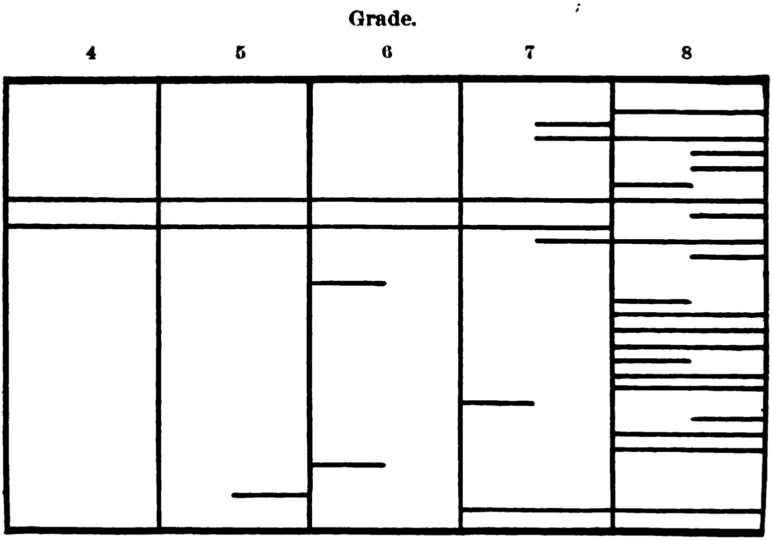

Fig. 15.—Ratio; the idea of ratio taught in most schools; usually emphasized in grade 8.

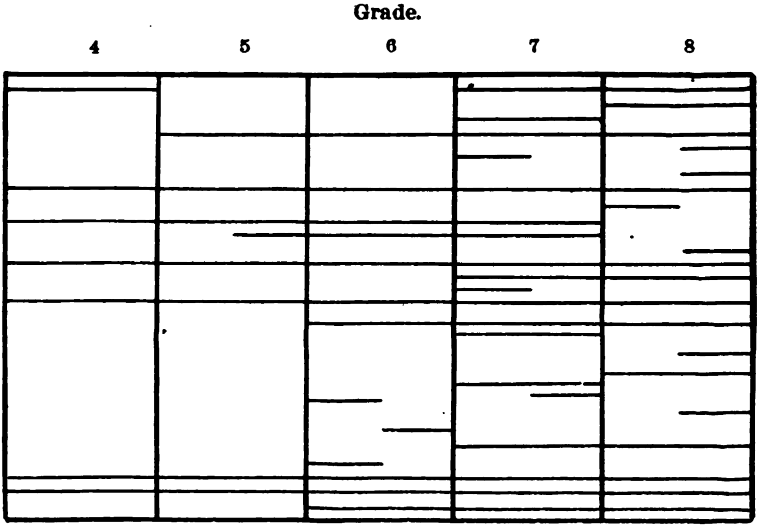

FIG. 16.—Mensuration of plane figures; taught in all schools; being spread out over the grades.

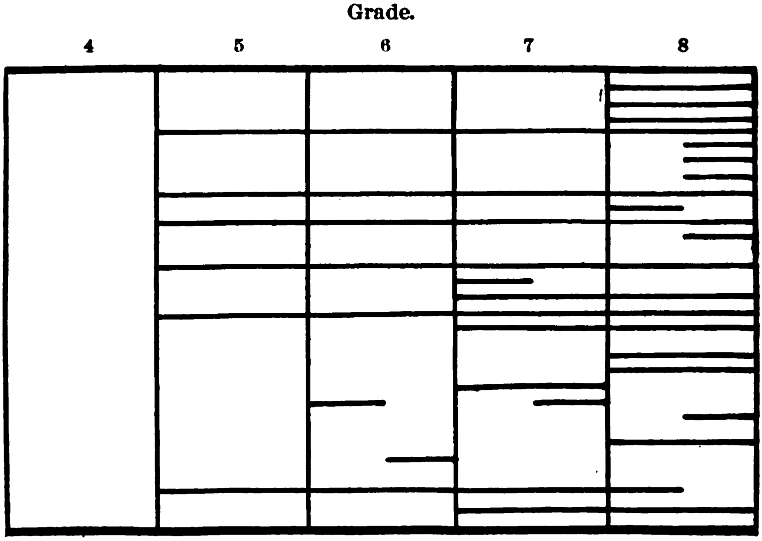

FIG. 17.—Mensuration of solids; taught in most schools; most commonly emphasized in grade 8.

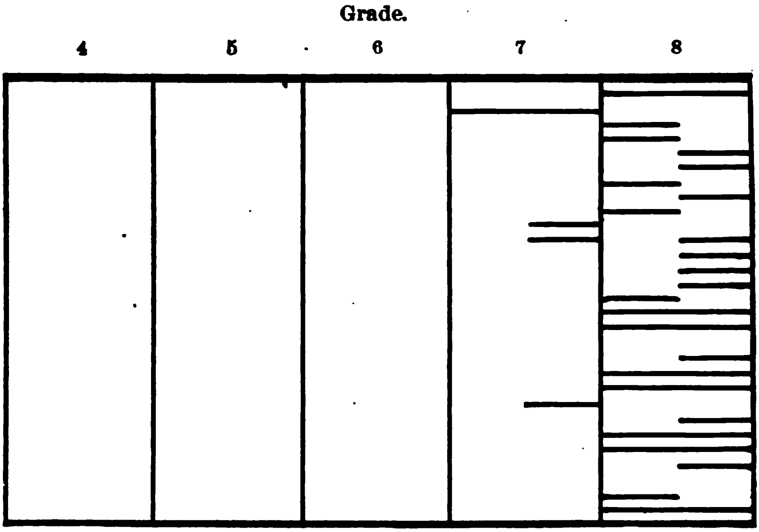

FIG. 18.—Square root; taught in most schools; usually in grade 8.

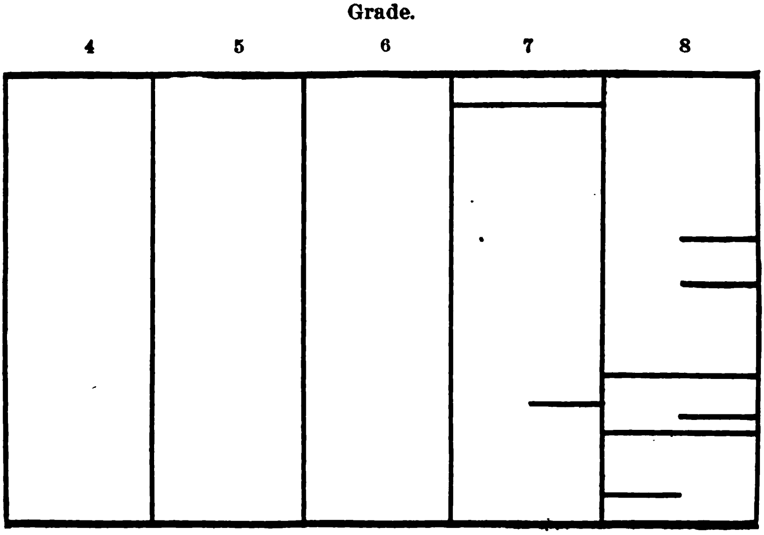

FIG. 19.—Cube root; taught in 28.5 per cent of the twenty-eight schools; usually in grade 8.

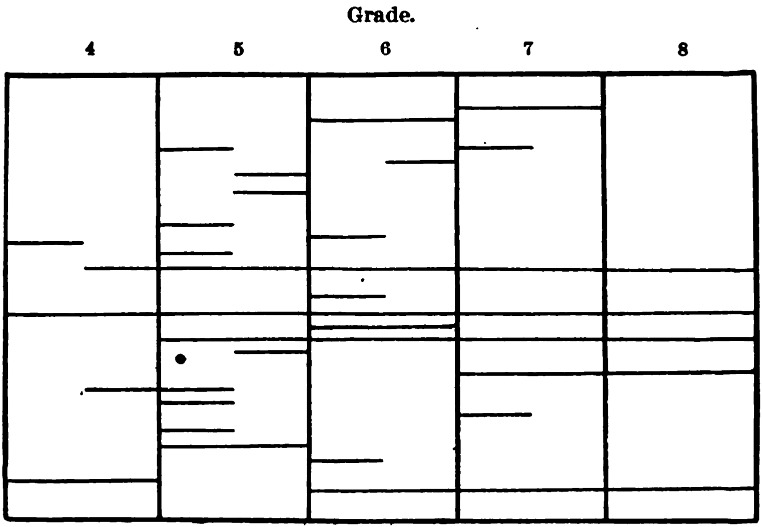

FIG. 20.—Factoring; taught in most schools; most commonly emphasized in grade 5 or 6.

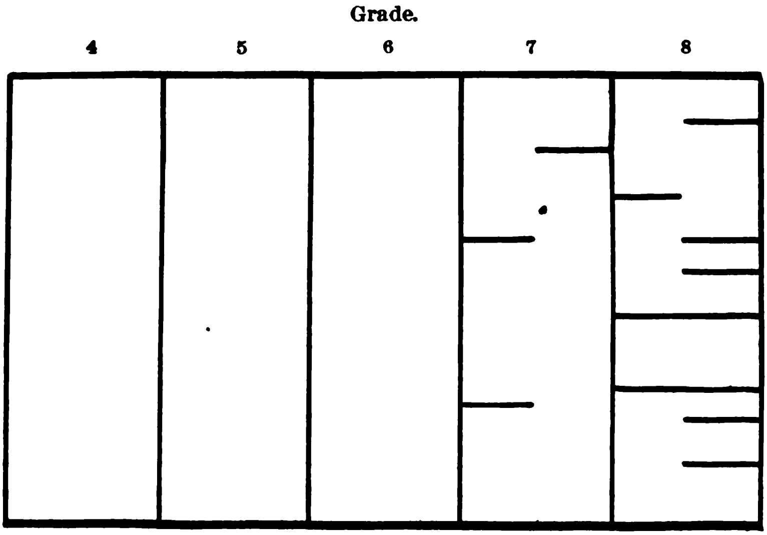

FIG. 21.—Metric system; taught in 35.7 per cent of the twenty-eight schools; usually in grade 8.

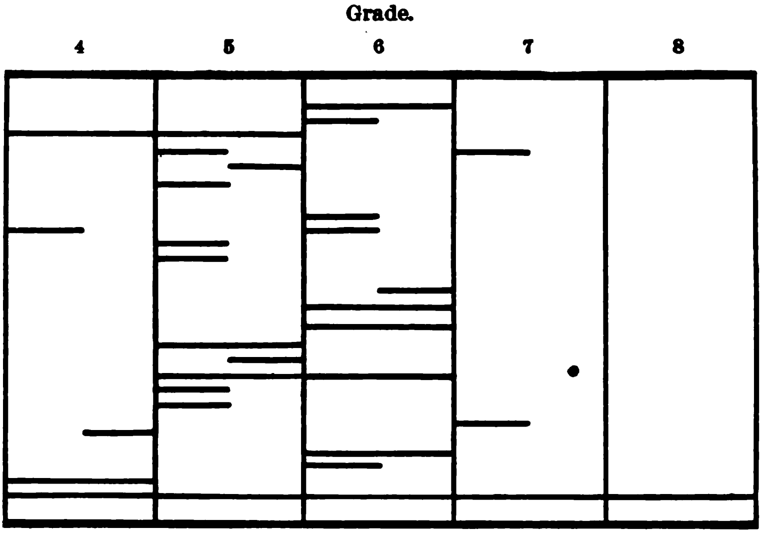

FIG. 22.—Least common multiple; taught in most schools; usually in grade 5 or 6.

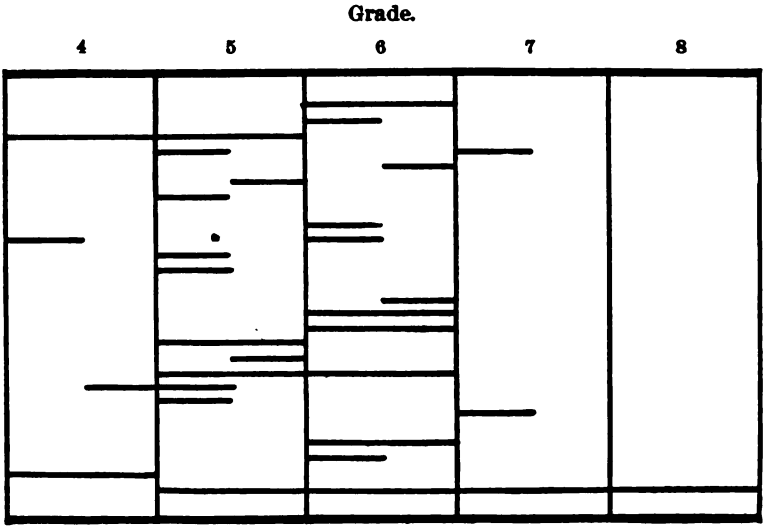

FIG. 23.—Highest common divisor; taught in most schools; usually in grade 5 or 6.

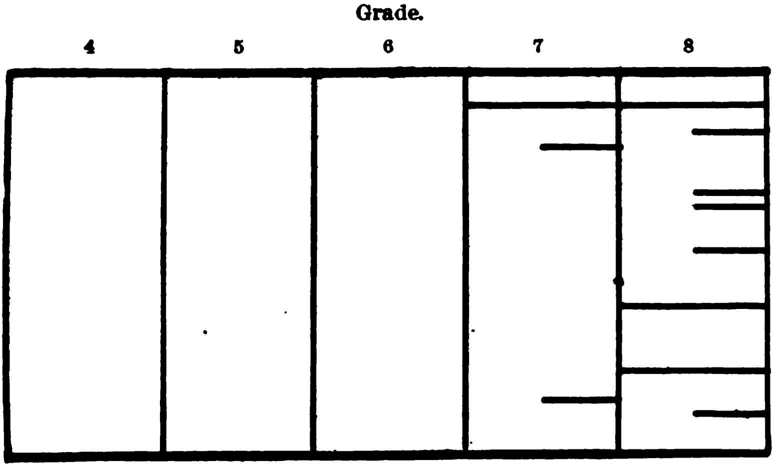

FIG. 24.—Algebra; taught in 35.7 per cent of the twenty-eight schools; usually in grade 8.

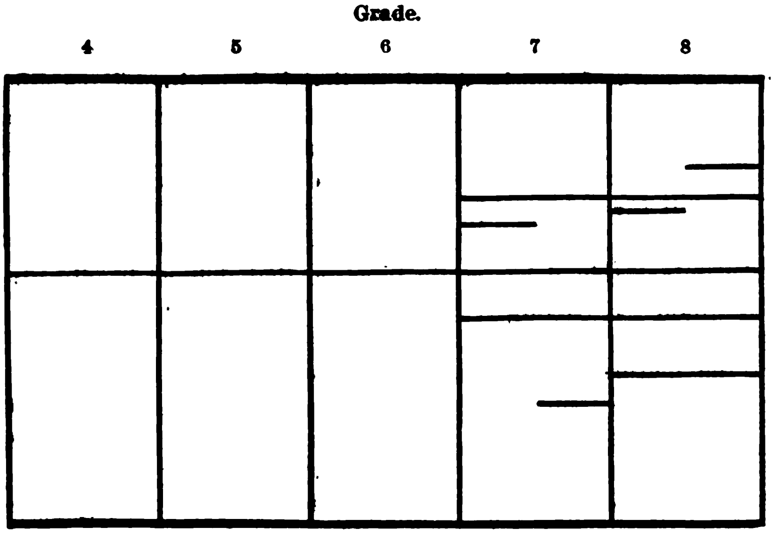

FIG. 25. Constructional geometry; taught in 28.5 per cent of the twenty-eight schools; usually in grade 7 or 8.

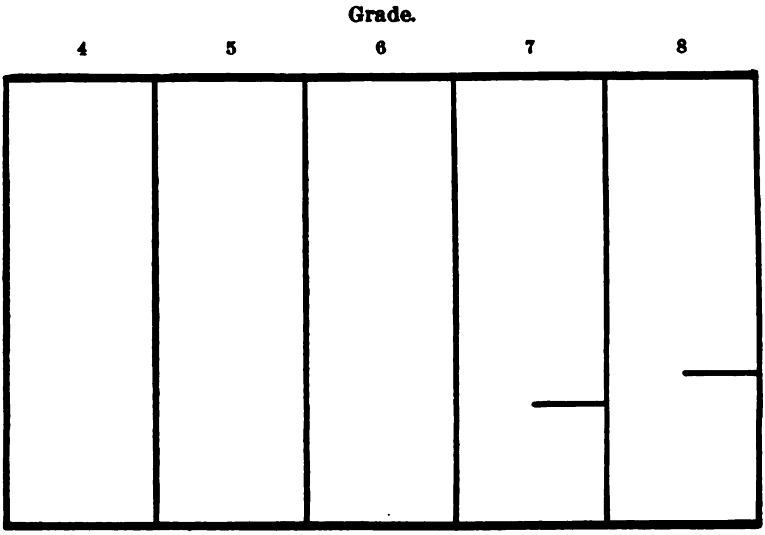

FIG. 26.—Graphical work; taught in 7 per cent of the twenty-eight schools.

TENDENCIES AS TO CONTENT OF COURSES.

Before considering the tendencies in the matter of the content of the curriculum, it would be helpful to consider carefully certain influences affecting the whole course of study in the elementary school. In order to economize space, however, a mere statement of these influences will be made. There is, among school men, and in the public to-day, an unwillingness to accept the doctrine of formal discipline as it was formerly stated, so that it is no longer possible to justify the retention of any topic or subject by claiming for it merely great disciplinary value; there is growing belief in the doctrine of interest as essential to will training, so that the possible attitude of the pupil toward a subject is taken into account more than formerly; there is greater and greater insistence upon the fact that the elementary school has as its function that defined briefly above, rather than, for example, preparation for the high school. All these influences would bear considerable discussion, for their effect upon the mathematics curriculum is very marked. For example, there is great pressure to simplify the course. This is being done by using smaller numbers in the work in arithmetic; by eliminating topics that are unduly confusing; by giving carefully graded simple problems; and by cutting down the extent and increasing the emphasis on the part that remains. There is also great pressure to modernize the course. This is being done by omitting obsolete problem material, topics, and processes, and by substituting therefor modern problem material. There is pressure to make the subject possess informational value as well as disciplinary value. This is being done by a change in the problem material, such as introducing problems about our national resources and problems of local interest.

DISTRIBUTION OF THE MATERIAL THROUGH THE GRADES.

There are two general modes of organizing the whole course of study which have received much support. One is known as the topical plan, according to which each topic is treated once within the course of the eight grades, after which it is to be retained by the pupils. The other plan is known as the spiral plan, according to which each topic is touched upon repeatedly and more or less frequently throughout the course, so as to provide the necessary reviews. In its extreme form this plan may become highly confusing to teacher and class and may lead to a lack of sufficient concentration. The modern tendency seems to be to recognize and take advantage of the good in both plans; to adopt the spirit of the topical plan, to the extent that at various stages of the course certain mathematical ideas are stressed and certain number facts learned; and to adopt the spirit of the spiral plan, to the extent that there is frequent review of the essentials, so that the inevitable tendency of the pupils to forget is counteracted.

TYPICAL COURSES OF STUDY.

Further discussion of the content of the course might be given. As a matter of fact, there is only one satisfactory way to get a good idea of the content of any course and that is to read the course itself. This same remark might be made in regard to the subject which will be discussed in the next chapter, the matter of method in teaching mathematics, the manner in which the schools seek to influence method also being understood best by examining a course of study. Some courses of study are given in Part VI of this report.

III. EXAMINATIONS FROM THE POINT OF VIEW OF THE SCHOOL.

KINDS OF EXAMINATIONS CONSIDERED.

Although the American commissioners have assigned the subject of examinations to another committee, it seems proper to mention it briefly in this connection.

Examinations given in the school are of three kinds: (*a*) Those given by the teachers themselves; (*b*) those given by the supervising officers of the schools; (*c*) those given by a school to determine the qualifications of pupils proposing to enter the school.

The examinations given by the teacher are of two kinds; the ordinary " written recitations " and the stated examinations which may be required by school regulations. The first should not be called examinations in one sense of the word; they cover usually a short period of previous instruction, and they are given as a means of affording the same sort of drill to all members of the class or as a means of detecting weaknesses as a basis for further instruction. Such written lessons are left entirely to the teacher, although it is advised that they be given frequently. Such examinations are in every respect desirable when conducted by the teacher with due regard for the general welfare of the pupils.

The teachers are sometimes required to give their pupils a written examination monthly, quarterly, or at some other stated times, and to use the marks obtained by the pupils for the purpose of determining their fitness for promotion. These examinations are more formidable in character; they cover a greater amount of previous instruction; and they are designed to test the pupils' power. Because of their consequences, such tests are feared by the pupils; in many cases they are considered unfair, and the result upon the pupils is a nervous strain.

The use of these two kinds of examinations is very general, and in both types the teacher is usually permitted to make out the questions. The practice of giving such examinations at the close of the year is decreasing. These tests are clearly given as an aid in determining promotion of the pupils, and it is against this type of examination that considerable criticism has been directed on account of its effect upon the pupils. In these examinations, however, the teacher usually has the power to adjust the test to the capability of her class, and in reading the papers she can allow for individual peculiarities.

The examinations given by the supervisory staff are primarily considered an administrative expedient. The questions are prepared by the superintendent, or by a committee of principals working under the direction of the superintendent, and they are then used in all of the schools of the system. The teachers have only in rare instances the right to add to or to change the questions before submitting them to their classes. The teachers mark the papers and then usually submit the results to their principals. These examinations are given for the purpose of setting standards of work throughout the system, interpreting the course of study, promoting uniformity, discovering weak points in the teaching, and revealing the general conditions in the school. In a broad way they are designed to benefit the pupils only indirectly, since the emphasis is placed upon the administrative advantages. The results may be used occasionally in determining a pupil's fitness for promotion, although it is seldom that failure in the examination alone would retard a pupil's progress. As an administrative device these examinations are effective. Their success depends upon the wisdom, the experience, and the ideals of the supervising officers. As a rule the examinations do not meet with favor among the teachers, who feel that the test is not so much intended for their pupils as for themselves. From what has been said it is apparent that this is true to a large extent, although this depends upon the supervising force. Many of the teachers, recognizing the advantages gained through the examinations and having high professional ideals, do not take this view, however, and are willing to have their work compared with that of their colleagues. The examinations are opposed also because of their effect upon the pupils. It is contended that the pupils are subjected to a severe nervous strain, so that they do not do either themselves or their teachers credit. This is possibly true to an extent, although the evil results may be greatly lessened under wise supervision. Another objection made to such examinations is that they hamper the teachers in their work, so that there is little progress from year to year. This again depends upon the character of the supervision. Another objection made to such examinations is that fession works up to the supervising positions, and this element may be counted upon to promote rather than to hinder real progress in the schools.

REASONS FOR GIVING EXAMINATIONS.

Examinations have been ranked highly for reasons that vary according to the school employing them. Some feel that the value lies in the "mark" obtained by the pupil, this mark being sometimes counted as one-half of the pupil's standing and at other times counting as only a small per cent toward his rank in class or his readiness for promotion. Others deem that the practice in organizing quickly, in thinking clearly, and in stating accurately is the main value of examinations, a theory that tends to the use of monthly or biweekly examinations. Other schools find the worth of examinations to lie not in the benefit to the pupils (save indirectly), but in the help given to the teacher in the opportunities to check objectively her subjective ranking of pupils and of class progress. In the latter case the examination papers may not be returned to the pupils, the teacher noting the errors on which to work with both class and individuals. The other prominent reason for giving the examinations, the administrative advantages, has already been discussed.

TENDENCY IN THE USE OF EXAMINATIONS.

The present tendency in the use of examinations is to rank them as valuable but to let the value and the use of the papers be determined by the aim. When the pupils are to be benefited directly by practice (1) in separating essentials from nonessentials, (2) in clarifying a viewpoint through the enforced expression of it, (3) in learning to interpret the printed or written page independently, or

(4) in being tested on memory or power, then tests should be frequent, they should be carefully looked over by the teacher, and soon thereafter they should be made the basis of further instruction. Tests to further the first three of these ends are being given increasingly. Those tests or examinations of which the purpose is to help the teacher check her judgment of the pupils and test the portions of subject matter taught as to their relative value in giving the pupils ideals of and practice in perseverance, honesty, independent thought power, etc., need not be returned to the pupils. The teacher will note in this case the errors and will attempt to classify them; for example, as errors due to ignorance or to carelessness, those important or relatively unimportant, and class or individual errors. Such examinations are a form, and a very desirable form, of recitation.

STANDARDIZED TESTS.

Another view of the question of examinations concerned itself with "standardized tests." An investigation by questionnaire sent to a large number of schools showed that these tests are little known or used. These tests are discussed especially in a book, Arithmetical Abilities, by Dr. C. W. Stone, and published by Teachers College, Columbia University, New York. This book discusses certain tests given with extreme care in 26 school systems. The replies were carefully graded, the results examined, and deductions drawn. As a result these same tests can be used as a standard in other systems, giving an opportunity to compare results with those obtained in the 26 systems. Some schools and systems of schools have done this.

These tests may also be used to give a somewhat definite means of comparing system with system and to show the effects of changes in curriculum or in method of instruction, and doubtless an acquaintance with them would indicate other uses to which they could be put.

IV. METHOD OF INSTRUCTION IN ARITHMETIC.

By method of instruction in arithmetic is meant the special means of presenting certain knowledge of arithmetic to children in a way which is adapted to the immaturity of their minds. Such a method of necessity involves consideration of the subject matter selected for the course, of the organization and distribution of the material, and finally of the manner of bringing it before the pupils. The difficulty of making any general statements which shall apply to the country at large is very great, for in a country with school conditions such as exist in the United States there are and always must be wide variations in all three respects. Some common characteristics may be pointed out as being typical of the practice in the country; these may be inferred, first, from the content and organization of the textbooks, and, secondly, from the known practice in some of the larger or more progressive school systems. There are some reform tendencies also to which attention should be directed.

Certain influences affecting the work of all of the subjects of the elementary school have produced, and are producing, changes in the method of instruction in arithmetic. On the part of the schools themselves there has been a growing regard for the ideals of psychology and pedagogy, and an increasing effort to put these ideals into practice as these have become more clearly defined. The ideal of appealing to the interests of the pupils, the maxim of allowing the pupils to learn through their own activity, the falsity of the doctrine of formal discipline as formerly understood, the clearer understanding of the processes of perception and of apperception with the resulting theory of developmental or inductive teaching—these and other ideals have led to changes in the methods of instruction from within the schools. These changes have only started, however, and the present must be regarded as a transition period. On the other hand, there have been other changes brought about as much if not more under pressure from without the school. There has been a growing independence on the part of the public in the matter of educational opinion; the result has been less acceptance as gospel of the statements of the schoolmen, more questioning of the worth of each and all of the subjects taught, and more insistent demand that the schools endeavor to provide instruction which will harmonize with and prepare for the conditions of modern life. There is on all hands growing sympathy for children, as a result of which their burdens are being made lighter, and, in particular, their period of school life is being looked upon not so much as a period of discipline in preparation for a further life of unpleasant tasks, but rather as a portion of their life which they can and should be helped to enjoy. In response to this influence, which has met with ready reception within the schools, there has come a tendency to simplify the work as much as is possible.

Instruction in arithmetic in the past has been dominated largely by a logical ideal and a disciplinary aim; these influences can be observed in the subject matter, in the organization of it in the textbooks and in the means employed in presenting it to the pupils. The criterion observed in the selection of material for the course has been " to what extent is this topic necessary to round out the development of arithmetic as a mathematical topic"; topics were selected frequently because they had certain mathematical interest rather than because they met some actual need of the pupils in either their present or later life. Long lists of abstract problems of unnecessary difficulty and complexity were introduced regardless of the fact that they were much more involved than any met in actual practice by most people. The concrete problems usually followed the abstract, were equally difficult, and seldom were designed to appeal to the interest of the pupils; up to within recent years the problems often involved matters which are entirely obsolete. This material was organized topically; in the first chapter was given a treatment of notation and numeration which was designed to meet the complete future needs of the pupils, containing such numbers as billions, and beyond. Then followed chapters which contained the treatment of the four fundamental operations for integers, and so on through the course. Logically this arrangement was a natural one, but psychologically it was open to criticism. In the presentation of the material the book was again permeated by the logical ideal. Processes were either given by a rule followed by an illustrative example and exercises for the pupils, or some abstract explanation of the rule was attempted. The former method was the more common. This was a period of direct instruction and of drill on the part of the teacher, with little effort to provide any basis of experience for the pupils upon which they might build their arithmetic.

These ideals of instruction have by no means entirely passed, but in most of the textbooks in use now there is evidence of response to the influences mentioned in a former paragraph. This is a time of transition from the extreme of these views of the past to the more rational methods of the present. In the meantime the schools have passed through a period in which the quest after better methods has led some to adopt certain well-known one-idea methods. As examples of these may be mentioned the Grube method, with its attempted complete study of one number before passing on to the next, and the ratio method, in which the complete development of arithmetic was made to yield to a special mathematical form.

Whereas in the past instruction in mathematics in the elementary grades has been dominated by logical ideals and a disciplinary aim, at the present the leading purpose is to make the instruction as useful in content and as pedagogical in form as the conditions of school work permit. In regard to its content, remark has been made in a previous paragraph of the tendency to simplify the course through the omission of unduly complicated problems and of topics which have mathematical rather than general interest; with these omissions has come a greater insistence upon the essentials of arithmetic and additional problems whose special function it is to give the pupils an insight into certain phases of the life of their own country. The mathematician may fear that this process of elimination will result in a lower standard of mathematics; the fear is groundless, however, for the effort to direct attention to a more complete mastery of the fundamentals can not fail to raise the standard of mathematical equipment of the pupils.

Reference has been made also to the general organization of the material of the course in a previous part of this report, so that only a brief statement will be necessary at this point. The modern texts in most common use employ a combination of the older topical method and of the extreme form of the spiral method. The text is usually divided into sections which contain sufficient material for one-half year or one year. Within these sections the material is arranged topically; each section, however, reviews some or all of the topics contained in the previous sections. In this manner opportunity for review is provided and a better gradation of the material is made possible.

The remainder of this section of the report will be devoted to a brief statement of some of the special means employed for bringing the arithmetic before the pupils.

In all schools instruction is given to groups of pupils varying in number from five in small communities to thirty or even more in some of the larger communities; in cities the average is about 25. As a rule the arithmetic class meets daily for from 20 to 30 minutes, in a period called the class or recitation period; the pupils usually have another period of about the same length for study in school, giving a total of from 200 to 300 minutes per week for arithmetic. Custom in regard to home study varies; the tendency is to cut down on home study in arithmetic, except possibly in the upper grades. Each pupil possesses a book, which is more than a mere collection of problems; in fact, this book provides for many classes about all of the "explanation" or development that some of the pupils ever receive. In most cases, however, new topics are taken up in class by the teacher, who gives such development of the topic as seems satisfactory to her, after which the main responsibility of the pupils consists of the solution of similar problems in their study time. In the past it has been all too common for the class time to be occupied with indiscriminate recitation on this work done by the pupils in their study time; the present tendency is in the direction of use of this class period either for instruction on new topics or for vigorous drill upon past and present work under the direction of the teacher. Another characteristic of the class period is the rather uniform practice of devoting from one-third to one-half of the time to mental arithmetic, i. e., to computations without the aid of pencil and paper. The function of this type of work is to produce skill in mental computation, and, secondly, to maintain and increase efficiency in the portions of the subject taught previously, by having the pupils solve many simple problems.

In the actual presentation of new topics, custom varies from the unsatisfactory plan of direct instruction, of mere telling of the fact or of the process and of drill upon it until the pupils know it, to the desirable form of presentation in which some capable teacher consciously and successfully develops the new idea inductively. One of the obvious effects of the influence of psychology upon method is the greater insistence upon inductive or developmental teaching. Unfortunately, the mass of teachers have an entirely inadequate idea of the underlying psychology and in fact of the essentials of this general mode of procedure in teaching a new topic. Most of the teachers are impressed with the need of teaching the simple before the complex, the concrete before the abstract, the special before the general; but clear-cut ideas of the philosophy of the practice and of the function of the definite stages which are possible in inductive teaching are usually lacking. This may be due to the fact that all of mathematics has been looked upon as a deductive science and that no special effort has been made to impress the idea of inductive teaching; it is probably so because little attention has been given to the problem of method as such. Progress in the direction of better understanding of the stages of mental development has been reflected in the more progressive schools in efforts to provide a teaching method in harmony with this knowledge.

The practice of using objective aids in presenting new topics is the most common result of the efforts to regard the teachings of psychology. The texts and the teachers endeavor to lay a foundation of experience for the pupils upon which they can build their mathematics, and belief in the efficacy of objective work in accomplishing this is quite general. The theory behind this belief is often the crude idea that objects help and that the younger children need this assistance more than do the older ones, with the result that objective aids have been used decreasingly from grade one to grade eight. The relation of objective work to inductive teaching has not always been clear; that the use of objects helps sometimes to present to the pupils clearly individual cases of some general idea which is being taught, out of which the pupils are to form the general idea by a process of generalization—this fact is not as widely understood as would be desirable. The result has been a certain amount of waste in the use of objective aids and consequent dissatisfaction with such work. There has been a tendency to use objects too much in the lower grades, and, on the other hand, there has been the fault of not using objects sufficiently in the upper grades. While this may seem to represent an inconsistent state of affairs, the explanation is easy; the objects have been used to excess at times with young children and then, for the reason mentioned above, when new topics have been undertaken in the upper grades, this means of aiding the older pupils has been neglected, with the result that the pupils have not always gotten clear ideas. The great desideratum at the present time is that objects should be used more understandingly.

The material used in the schoolroom as objective aids is limited and highly artificial, consisting of tiles, pegs, splints, toothpicks, squares of cardboard, etc. This material has the special advantage of being adapted to the conditions of schoolroom work; it is inexpensive, compact, easily handled and not too attractive. Besides this material which can be handled, there is a growing use of geometrical figures, especially of rectangles; these can be quickly drawn, are easily changed and adapted to the conditions of particular problems, are divisible, in fact, lend themselves readily to the needs of the situation. The use of rectangles in teaching fractions is especially to be mentioned. In the selection of objects, two qualities which are particularly desirable, in fact, necessary in some cases, are not always realized and when realized are not always readily obtainable; these are the elements of naturalness and variety. The element of naturalness is probably sufficiently appreciated; in the early grades, the pupils themselves, the seats in the room, the material which is distributed in connection with the work of all the classes, the selection and grouping of the pupils for their games, these are some of the more natural sources of material for concrete expression of the number facts studied. Similar material for use in the upper grades is not always so readily obtained; of course, in connection with denominate numbers, the actual weights and measures are brought into the schoolrooms in the progressive schools. As much as possible, the problem material in all of the grades is selected from the experience of the pupils, and the actual conditions of some of the topics are reproduced in the schoolroom. For example, in teaching stocks and bonds, the class may resolve itself into a broker's office, one member of the class acting as the broker and the rest of the class acting as buyers or sellers of stocks and bonds; again, the class in a lower grade may resolve itself into a store with similar distribution of responsibilities among the members of the class; when discussing commercial paper and business forms, samples are brought into the classroom so that the pupils may get the feeling that there is a real connection between the work they are doing in the schoolroom and that of adults who are engaged in the work of the world. An effort is made to permit the pupils to handle the material themselves.

The other quality mentioned as desirable, namely, variety, is not appreciated as much as it should be. The advantage in having a variety of objects as a means of arousing interest is usually clear, but the necessity of variety in presenting particular cases of a general idea which is being developed inductively is not clearly understood. For example, in presenting the idea of tens, bundles of splints containing 10 splints are often used; the pupil soon learns to associate the word ten with one of these bundles without really understanding that the bundle contains 10 splints. This difficulty is obviated somewhat by using a variety of means of representing 10. Other illustrations might be given to make the point that in objective teaching care must be taken to prevent too immediate association of the idea being taught with any particular manner of representing that idea in a concrete way.

By way of summary of this section, devoted to the discussion of methods of teaching arithmetic, it may be said that there has been great progress in establishing the principle that psychological rather than logical ideals should permeate the teaching of arithmetic, and that there has been some progress toward incorporating this principle in the actual teaching practice, in the form of objective work and inductive developments.

V. TRAINING AND QUALIFICATIONS OF TEACHERS.

SCOPE AND SOURCE OF MATERIAL.

Part V deals with the training and qualifications of teachers of mathematics in the elementary schools. It is based in large part on the report of subcommittee No. 3 of this general committee, whose field of study was limited to the training of teachers for work in grades 1 to 6. The committee appointed to study the same problem for grades 7 and 8 was unable to report up to the time when this summary was first made. That report has since been added to part (b) of this general report.

GENERAL TRAINING.

In an earlier paragraph the statement was made that in the country at large over 425,000 teachers were employed in 1906, and that about 100,000 new teachers are employed annually. Further statistics show that not more than 20,000 of these can receive pedagogical training annually as that is the limit of the capacity of professional training schools of all sorts in this country. At best, therefore, not more than one-fifth of the new teachers can have received any professional training whatever.

Generally, even in the districts where educational advantages are very meager, prospective teachers must be high-school graduates. Graduation from high school implies the completion of a course equivalent in content to the following: Three years of English, four of Latin, two and one-half of mathematics, two of science, two of history, and two years of additional subjects. In addition to this scholastic training the prospective teacher must attend a normal training school within the limits mentioned. In some States a minimum length of time must be spent in such school. In most of the cities, in which, as has been said, more than one-half of the population is gathered, this normal training and even previous experience is absolutely insisted upon. It might be said at this point that many of the best teachers in the schools owe most of their training to the hard school of experience, especially hard when that experience consists of service in one of the rural schools discussed in chapter one. It may also be said that the larger cities seek recruits for their teaching staff very commonly from the graduates of this same school of experience.

TRAINING IN THE NORMAL SCHOOL.

The training in a normal school usually consists of general pedagogical theory, some special training in the methods of the different subjects including mathematics, some academic study of the subjects, such as algebra in mathematics, some observation of teaching, usually in all subjects, and more or less practice teaching.

From a study of the practice of the normal schools the following points of variability seem existent:

1. Method of teaching enters into "methods" courses from the extreme of being merely incidental to the other of occupying full time and attention.
2. Current literature on the teaching of mathematics is sometimes used extensively and sometimes not used at all.
3. Similarly with consideration of games and recreational devices in arithmetic; sometimes they are considered, and again not.
4. The course of study for the whole curriculum is sometimes not studied and is sometimes carefully analyzed.
5. The history of the development and of the teaching of mathematics is given similar varying emphasis.

RECOMMENDATIONS FOR A TEACHING COURSE.

1. A foundation in subject matter as a basis for the professional study of mathematics should include a minimum of one-half year of high-school arithmetic, one year of algebra, and one year of geometry.
2. Exclusive of all courses in psychology, pedagogy, principles of teaching, general method, and history of education, a minimum of one-half year of the professional study of arithmetic should be required to include the following:
    A. The teaching of elementary mathematics—" Special Method."
        (*a*) The special pedagogy of arithmetic.
            1. The more elementary phases of the psychology of number.
            2. Principles of general method applied to teaching arithmetic.

8. Educational values of arithmetic and the place of arithmetic in the general educational scheme.
(*b*) The organization of the general elementary school curriculum in arithmetic.
(*c*) Organization of typical units of subject matter for presentation to appropriate grades.
(*d*) Development and writing of typical plans for teaching.
(*e*) The utilization of local and general economic studies for number applications.
(*f*) Observation and discussion of typical lessons in the grades showing concrete applications of the principles developed.
(*g*) The place of games and other recreational devices in grade number work.

B. The historical development of the teaching of arithmetic, and the place and value of certain "methods," such as those of Pestalozzi and Grube.

3. That every school engaged in the preparation of teachers of mathematics should develop a museum of materials, apparatus, books, pamphlets, papers, which will aid in interpreting such features as the historic development of the subject, the present-day practice, and the nature of the textbooks.

4. That the head of department of mathematics should be largely responsible for the organization of the course of study in mathematics in the training school, in cooperation with the department of education and the supervisor of the training school.

5. That the head of the department of mathematics should aid in the supervision of the teaching of mathematics in the training school.

6. That the head of the department of mathematics, as well as the critic teacher, should give demonstration lessons in the training school, illustrating the principles of teaching, developed in the methods class.

7. That the points of emphasis in all observations, discussions, written plans, and criticisms should be upon the basis of fundamental principles rather than upon devices or petty details.

VI. TYPICAL COURSES OF STUDY.

INTRODUCTION.

It is almost certain that much that has been given in this report will be intelligible only if interpreted. Since the main interest will probably center on the curriculum itself and upon the teaching helps given to the teachers and recommended for their use, it seems worth while to include in this report two typical courses of study. The first is the course of study recently issued for the guidance of the teacher of the rural schools of one of our States, but generally considered too difficult in the first two years. The second course has recently been prepared for the schools of one of our cities.

A STATE COURSE OF STUDY.[1]

SUGGESTIONS.

The work in arithmetic should, first of all, produce accuracy and rapidity in computation. Accuracy can be assured only by holding the pupil to exactly correct results from the beginning. Pupils should be held to correct results and made to detect and correct even the slightest error.

Rapidity of computation can be secured only through much practice and drill. Throughout the first three years of the work the entire time in the subject should be given to securing this accurate and rapid work in the fundamental operations.

While drill in the facts of number during the early grades should be largely in the abstract, with few if any problems, it is suggested that some concrete work in these combinations be given. Illustration: 5 dollars and 4 dollars are how many dollars?

FIRST YEAR.

(FIRST HALF.)

Count numbers to 100. Read numbers to 100. Write numbers to 100.

Memorize the 20 of the 45 combinations in addition, the sum of which does not exceed 9.

Give plenty of oral drill together with seat work and blackboard work like the following:

2 5 3 4 2 7   2 1 2 3 2 3 7 5 1 2 6
4 2 2 4 4 1   6 8 5 2 3 4 2 3 7 3 2

and have pupils get correct results by copying, where necessary, the results from the combinations placed upon the blackboard. This work together with oral drill and tests will in a short time fix these combinations in mind without the use of objects and the consequent formation of the pernicious habit of counting the fingers in adding.

From the first, drill in these combinations should be given in such manner as to prepare for subtraction as well as addition.

Illustration.

Teacher—Five-four?
Pupil—Nine.
Teacher—Five and what are nine?
Pupil—Five and four are nine.
Teacher—Four and what are nine?
Pupil—Four and five are nine.

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[1] Prepared by the Education Department of New York State. As here given the course is somewhat abridged.

When the combinations are learned in this manner, the work in subtraction, if taught by the Austrian method (sometimes called the addition method), is learned at the same time as addition.

Illustration.

8 7 6 3 9
— 4 2 3 1 6

Method.

6 and 3 are 9.
1 and 2 are 3.
3 and 3 are 6.
2 and 5 are 7.
4 and 4 are 8.

At the close of the first half year pupils should be able to count, read, and write numbers to 100. They should know the 20 combinations, the sum of which does not exceed 9 and their use in addition.

Objects should be used only for consecutive counting and developing the idea of number in the abstract. Children should never be taught to count two groups of objects to find the sum. This gives the idea that addition is counting, which is a serious hindrance to accuracy and rapidity in work. Nothing has done more injury in number work than the too long continued and injudicious use of objects in its teaching.

SECOND HALF.

Continued drill in addition and subtraction with the 20 combinations learned in the first half.

Count to 100 by twos, by fives, by tens.

Drill in adding columns of figures on board and cards arranged for this purpose, the sum not to exceed nine.

Memorize the remaining 25 combinations in addition.

Give oral drill, seat, and blackboard work in plenty with examples like the following:

6 8 4 5 3 2 4   8 6 9 3 4 5
4 3 8 6 9 7 8   1 2 4 5 8 8

Children are here taught to carry in addition.

Method. Teach the very best model, insist upon its exact imitation and much repetition and drill. Make no attempt to explain the process. This is the time to teach the art of computation, not the science of numbers.

SECOND YEAR.

(FIRST HALF.)

Continued drill in the use of the 45 combinations in addition and subtraction.

Drill on series work in addition.

Illustration.

2 12 22 32 42 52
5 5 5 5 5 5

Continue drill by counting by twos, threes, fours, fives.

Illustration.

Count to 50 by twos beginning with 0, beginning with one.

Count to 50 by threes, beginning with 0, beginning with 1, beginning with 2.

Count to 50 by fours, beginning with 0, beginning with 1, beginning with 2, beginning with 3, etc.

Drill in subtraction—Austrian method.

Illustration.

$$\begin{array}{rl} 1235 & \text{6 and 9 are 15.} \\ -\ 786 & \text{9 and 4 are 13.} \\ \hline 449 & \text{8 and 4 are 12.} \end{array}$$

The entire time of this half year should be given to use and drill of the facts of number learned as here specified. By the close of the period simple numbers will be added and subtracted with accuracy and facility and much progress made in the addition of columns of figures.

SECOND HALF.

Notation and numeration of numbers through first three periods.

Continued drill in addition and subtraction, especially in the addition of columns.

Memorize the 45 combinations in multiplication.

Teach these combinations so that preparation is given for division at the same time that multiplication is being taught, that is, have the pupil answer the questions, how many sixes in 24 and how many fours in 24 as well as to state that 4 times 6 are 24.

Give much oral drill, seat work, and board work of the following character:

$$\begin{array}{r} 3\,2\,6\,4\,5\,3 \\ 2 \\ \hline \end{array} \quad \begin{array}{r} 8\,6\,2\,4\,5 \\ 3 \\ \hline \end{array} \quad \begin{array}{r} 2\,0 \\ 2 \\ \hline \end{array} \quad \begin{array}{r} 3\,0 \\ 3 \\ \hline \end{array} \quad \begin{array}{r} 4\,0 \\ 4 \\ \hline \end{array} \quad \begin{array}{r} 5\,0 \\ 5 \\ \hline \end{array} \quad \begin{array}{r} 6\,0 \\ 6 \\ \hline \end{array}$$

Teach the process of carrying in multiplication.

(1) A good model. (2) Imitation of the model. (3) Repetition, drill. (4) No explanation.

THIRD YEAR.

FIRST HALF.

Continue drill in counting. Count by fives to 100, beginning with 0, beginning with 1, beginning with 2, beginning with 3, beginning with 4. Count by sixes, beginning with each of the numbers from 0 to 5, inclusive.

Short division with 2, 3, 4, 5, 6, 7, 8, and 9 as divisors. Give thorough and systematic oral drill as a preparation for this work. Before asking a child to use 2 as a divisor, he should be able to tell instantly how many times, with remainder, 2 is contained in every number to 20. When 3 is used as a divisor, a similar drill should be given in numbers to 30, with 4 to 40, with 5 to 50, with 6 to 60, with 7 to 70, with 8 to 80, with 9 to 90.

Multiplication with two or more figures in the multiplier.

Definitions of terms used in fundamental operations. Addend, sum, minuend, subtrahend, remainder, multiplicand, multiplier, product, dividend, divisor, quotient.

Continue drill of all previous work.

Measures—areas of simple figures with use of ruler correlating with drawing. Dimensions used inch and foot. Square inch and square foot, and the fractions ½ and ¼ as applied in the use of the linear unit used in measuring.

SECOND HALF.

Long division. Never allow a child to use long division when the divisor is a single figure.

Multiplication tables of the tens, elevens, and twelves and their use as divisors in short division.

Begin long division with easy divisors of two figures. Remember that 31, 41, 51, 61, 71, 81, and 91 are easier divisors than 14, 15, 16, 17, 18, and 19, 27, 37, 58, 76, etc.

Give much oral drill and written work for accuracy and rapidity in all of the fundamental operations.

Tests for divisability of numbers by 2, 3, 5, 9, 10.

Definition of factor, prime factor. Memorize prime factors up to 25 (1, 2, 3, 5, 7, 11, 13, 17, 19, 23).

Oral drill in finding prime factors to 100.

Continue measurement of objects in schoolroom for surface measurement. Additional measure: The linear yard. Learn liquid measure of pint, quart, gallon.

At the close of this year's work the pupils should be able to add, subtract, multiply, and divide numbers with accuracy and facility.

FOURTH YEAR.

FIRST HALF.

Roman numerals I to C and by hundreds to M.

United States money. Writing and reading of numbers expressing dollars and cents. The use of this knowledge in problem work demands its introduction at this time.

Simple problems, oral and written, connected with daily life. Original problem work by the children. Problems in bills and accounts, especially where one of the factors is 12 or less the extension of the products making up the sum to be done mentally.

Teach cancellation. Have all problems stated before being worked. Use cancelation whenever possible in the solution of these statements.

Dry measure: Pint, quart, peck, bushel. Problems in reduction only.

Simple fractions and equivalents. Develop objectively. Also teach idea that a fraction is an indicated division with the dividend above the line and the divisor below it.

Fix the principles: (1) Multiplying the numerator or dividing the denominator of a fraction by any number, multiplies the fraction by that number. (2) Dividing the numerator or multiplying the denominator of a fraction by any number divides the fraction by that number. (3) Multiplying or dividing both numerator and denominator by the same number does not change the value of the fraction.

Continue drill throughout the year in the fundamental operations. Facility in these operations demands that this work be continued daily throughout the entire course.

Changing fractions to equivalent fractions of higher and lower demoninations.

Give much oral drill in changing fractions to equivalent fractions of higher and lower denominations and in reducing them to a common denominator. Denominators of these fractions should not exceed 24.

Make little use of denominators 13, 17, 19, 29, and 39.

Addition and subtraction of fractions, the denominators of which do not contain more than two figures.

SECOND HALF.

Addition and subtraction of mixed numbers involving fractions already used in the manner here indicated. (Mixed numbers should never be reduced to improper fractions in addition and subtraction.)

Least common multiple of numbers to 100 and application in reducing fractions to a common denominator. (Use method of factoring in equation form.)

$45 = 5 \times 3 \times 3$. $5 \times 2 \times 3 \times 3 = \text{L. C. M.}$
$30 = 2 \times 3 \times 5$ $5 \times 3 = \text{G. C. D.}$

Multiplication of—

1. A fraction by an integer.
2. An integer by a fraction.
3. A fraction by a fraction. Use cancellation in all cases where possible.

Written work in preceding cases should be preceded by much oral drill with simple numbers.

Division of—

1. A fraction by an integer.
2. An integer by a fraction.
3. A fraction by a fraction. Use cancellation whenever possible.

Have the written work preceded by much oral drill, as in multiplication of fractions.

Continue the solution of problems involving the principles and processes learned in all previous work.

Problems to be stated before being solved, including oral analysis.

Cubic measure. Volume involving cubic inches, cubic feet, and cubic yards.

FIFTH YEAR.

FIRST HALF.

Reading and writing of decimals.

Reduction of common fractions to decimal fractions and decimal fractions to common fractions.

Fundamental operations in decimal fractions. (The Austrian method of placing the decimal point in division is recommended.)

Memorize the aliquot parts of $1 or of $100.

Review tables of linear measure, square measure, and cubic measure.

Memorize number of cubic inches in a bushel and in a liquid gallon.

Reduction ascending and descending as applied to these tables.

Application of square measure to finding area of squares, triangles, rectangles, and to problems in painting, carpeting, and plastering.

Application of cubic measure to finding volume of rectangular solids, the capacity of bins and cisterns, cost of masonry.

(Teach accurate capacity by using 2150.42 cubic inches in a bushel; also approximate capacity by using one bushel equal to $\frac{5}{4}$ cubic feet. In liquid measure use 231 cubic inches to gallon, also $7\frac{1}{2}$ gallons = 1 cubic foot.)

SECOND HALF.

Memorize tables of avoirdupois weight, dry measure, liquid measure, English money, time, and circular measure. Also learn number of pounds in a bushel of potatoes, wheat, corn, barley, oats, barrel of flour, and apply in the solution of problems. Also learn value of franc, pound, and mark in United States money.

Reduction ascending and descending as applied to these tables.

Other tables in denominate number besides those memorized may be used in problems, but pupils should be allowed to refer to books for facts used.

Problems in the form of bills and accounts continued.

Sixth Year.

FIRST HALF.

Review the work of fractions, with special emphasis on the three questions:

1. To find a fractional part of a number.
2. To find what fractional part one number is of another.
3. Given a fractional part of a number and its relation to the whole, to find the whole.

Illustration: $\frac{3}{5}$ of 35=? What fractional part of 35 is 21? 21 is $\frac{3}{5}$ of what number?

Review denominate numbers and drill on industrial problems demanding their use.

Fundamental operations in percentage:

1. Any per cent of any number. Aliquot per cents. Use the term per cent interchangeably with hundredths. Learn thoroughly the aliquot parts of a unit and use interchangeably with hundredths and per cent. (See table given in first half of fifth year.)
2. The per cent one number is of another.
3. One number is a given per cent of what number?

Applications to problems.

SECOND HALF.

1. Profit and loss, including (*a*) marking goods; (*b*) trade discount; (*c*) cash discount.
2. Commission—using only practical and common problems.
3. Simple interest.
   - (*a*) To find interest on any sum of money for a given time at a given rate.
   - (*b*) The making of promissory notes and the computing of interest thereon.
   - (*c*) Problems in interest when three of the elements of P, R, T, and I are given to find the fourth.
4. The simple equation and the use of the unknown quantity x can be profitably used in the solution of some problems.

Seventh Year.

Pupils who have completed the work of the six preceding grades should be able (1) to read reasonably large numbers at sight and to write numbers rapidly from dictation; (2) to add problems 5 figures wide and 20 numbers deep accurately at a fair rate of speed, i. e., in about two minutes; (3) to perform all fundamental processes in arithmetic rapidly and accurately; (4) to reason quickly and explain simple problems; (5) to handle ordinary fractions—common and decimal—without hesitation; and (6) to comprehend the fundamental principles of percentage and their applications.

At the end of the seventh year any one of the following courses may be pursued: (1) To follow syllabus in algebra for the eighth grade; (2) to give a part of the time to arithmetic and a part to algebra; (3) to give the entire time to arithmetic.

If the study of arithmetic is to stop with the end of the seventh year it will be advisable to follow the syllabus for this year and to include such topics of the eighth year, i. e., stocks and bonds, insurance and taxes, as are deemed necessary to round out the subject.

If the arithmetic is to continue through the first half of the eighth year, leaving the other half free for algebra, it will be necessary to select those topics in arithmetic which are considered essential to the laying of a proper foundation for the study of advanced arithmetic. Under this condition it will be necessary to eliminate some topics in the eighth grade algebra.

If arithmetic is to be given in both the seventh and eighth years it will be possible to insure greater efficiency along industrial and commercial lines through reviewing, drilling on, emphasizing, and enlarging upon those processes and applications which are considered the essentials. Without attempting to follow the syllabus it is possible to introduce some algebra in the solution of problems in mensuration and interest by means of the simple equation and the use of the unknown quantity x.

Give plenty of oral drill in getting approximate results. This will tend to reduce error in computation. In business it is customary to apply some kind of a check to every result obtained. No good mechanic or business man would think of letting his results stand without some checking. Pupils should acquire the verification habit.

Mental arithmetic should occupy a large share of the time. Never allow pupils to use pencil if, in your judgment, the result should be obtained mentally.

In general, papers should be marked, as they are in business, largely by the accuracy of the result. If the result is wrong the paper is wrong. If the problem requires some interpretation a teacher may quite properly mark both for accuracy and for method.

Teachers should endeavor to get outside of the book and to have a large amount of drill material ready for each exercise. Use the mimeograph, or some other duplicating machine in the preparation of lessons. Teachers should, if possible, learn the business methods used by a mason, carpenter, paper hanger, painter, architect, banker, etc. Original problems can be obtained from these men and pupils may be sent to them to verify their own methods. The problems should be real if they pretend to be so. They should relate when possible, to the child's daily environment and to his other school work. They should be concerned with the school shop, drawing, and laboratory work. They should touch the questions of the supply of food, clothing, and shelter as related to our farms, shops, transportation facilities, to typical industries, and distributing centers.

Visits to the shops of craftsmen and trips to factories, banks, and business houses will clear up in the minds of the pupils the technical points involved in such problems and will add new interest to the work. The daily activities of our people must be drawn upon to make the arithmetic interesting, informational, and practical.

FIRST HALF.

1. Continue application of percentage—
   - (*a*) Interest, including commercial paper: (1) Six per cent method and short methods based upon it; (2) bank discount; (3) compound interest as applied to savings-bank accounts. Use tables in compound interest. The operations of depositing money, drawing checks, and figuring interest should become as real as the school can make them.
   - (*b*) Problems should be many but simple. Many should be oral. In many cases discuss the solution without requiring any actual computation. Drill on giving approximate results.
2. Ratio and simple proportion.

Ratio has some use apart from being an introduction to proportion. Fertilizers, metals, and liquids are mixed in given ratios. Proportion may be merely one method of writing simple equation. The relation of numbers expressed as ratios should be shown and simple problems involving proportion should be given. The use of the equation and the unknown quantity x should be used.

3. Powers and roots—
   - (*a*) Memorize squares of numbers to 25. Oral drill in their use.
   - (*b*) Square root and its applications in determining dimensions from areas of squares. Also its use as applied to the right triangle. Square root is necessary for the purposes of mensuration. However, its study has more value in training for reasoning than in its practical use, since many who use it employ tables. Pupils can comprehend it by the use of the diagram or by the formula.
4. Many miscellaneous and review problems should be given. The use of the equation and the unknown quantity should be used, whenever convenient, in their solution.

SECOND HALF.

1. Review the following tables until the pupils use them readily in their work. In the review of the tables of measures some attention might be given to the origin of such measures as yard, foot, inch, quart, acre, etc. In this way the pupil will find the work taking on new interest. (1) Measure of length, (*a*) linear; (2) measure of area, (*a*) square; (3) measure of contents and capacity, (*a*) cubic, (*b*) dry, and (*c*) liquid; (4) measure of weight, (*a*) avoirdupois; (5) measure of quantity, (*a*) paper; (6) other tables, (*a*) circular, (*b*) time; (7) money, (*a*) United States, (*b*) English.
2. Review of, and drill in mensuration, using practical problems involving surfaces of (1) parallelogram, (2) rectangle, (3) triangle, (4) circle, (5) trapezoid and contents of such solids as (*a*) cube, (*b*) sphere, (*c*) cylinder, (*d*) pyramid, (*c*) cone.

Strict geometrical demonstrations can not be given, but enough objective work can be offered to make the matter clear.

3. Begin by using problems all of which require the use of the same table and then drill on mixed problems, making them practical and real as far as possible. Teachers are advised that it is of little value for the pupil to memorize tables that are not to be used in practical life, or to commit to memory numerous equivalents that are readily found in the textbook when needed.

EIGHTH YEAR.

FIRST HALF.

1. Rapid calculation work.

In this drill include daily speed exercises. Set a reasonable time limit and hold the class up to it. This will fit the pupils for pressure work which is bound to come in business life. It may include practice in the following:

(*a*) Addition until pupils can add at the rate of from 75 to 100 figures per minute. Use group method.

Horizontal addition should be practiced. Example: 10 pieces of cloth—38, 82, 91, 46, 53, 67, 84, 75, 65, 69=670, at 50c=$335.

(*b*) Multiplication, when multiplier is 11, 22, 33, 44, etc. Example: 892×11=2 as unit figure; (9+2=11) 1 as tens; (8+9+1 carried=8) 8 as hundreds; (8+1 carried=9) 9 as thousands; final result 9812. Example: 596×22=13112. Same as preceding process except that each addition is multiplied by two before carried figure is added.[1]

(*c*) Cost of articles sold by ton of 2000 pounds. Example: 8942 pounds at $25.50 per ton=$8.942×(½ of $25.50)=$114.01.

(*d*) Interest practice, short method given above. Only a few practical short methods should be given. This work will help to sustain interest and develop rapid thinking power of concentrated effort.

2. Business forms.

Some drills should be given in making such forms as the following: (*a*) invoices or bills; (*b*) statements; (*c*) account sales—in commission.

It is not expected that the pupil will be taught an elaborate form of bookkeeping; but everyone should know how to keep simple accounts. These can easily relate to the income and expenditures of daily life in the home and on the farm.

SECOND HALF.

Stocks and bonds:

Pupils should know what a corporation is, its chief officials, its organizaton, its stocks or bonds, and its methods of declaring and paying dividends.

(*a*) Cost of a given number of shares at a given market value.

(*b*) Number of shares or bonds that can be bought for a fixed sum.

(*c*) Rate of income on an investment in stocks or bonds.

Insurance:

Insurance, fire, life, and accident, is an important factor in our life, and yet the technicalities in various types of policies, especially those of life insurance, are so difficult of comprehension that the school can hope to do no more than to give a general conception of the work of the various kinds of companies and to confine the problems to the simplest practical cases that the people need to know about.

Taxation:

The subject of taxation has a close relationship to civics, and when combined with it has a real interest to the pupils. It should be treated from the standpoint of local conditions.

Algebraic notation:

Algebra has some place in this grade, especially for the boys in the industrial course. Simple formulas are now quite common in the various mechanical trade papers. Many of these boys will have use for various mechanics' pocket tables, which involve the elementary operations and linear equations. Emphasis should be laid upon the study of formulas, so that the simple algebraic expressions of the trade journals and mechanics' handbooks may be read easily.

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[1] The committee does not feel called upon to comment upon such features as this. It must say, however, that the carrying of this work beyond 11 is not warranted.

RELATION TO MANUAL ARTS, HOUSEHOLD ARTS, AND AGRICULTURE.

Those schools that offer instruction in household and manual arts and agriculture have an excellent opportunity to relate this instruction to the book-work. A series of problems vitally relating to cooking, sewing, woodworking, mechanical drawing, and farming may be worked out. Such problems will not only touch the school life of the pupils but also the home life.

The suggestive outlines showing this relationship are not limited to a single year; neither are they necessarily entirely taught by the teacher of arithmetic. They furnish a splendid field for coöperative effort between the special teachers and the room teachers. Each might well know what the other is doing, and attempt to fix in the pupil's mind the applications of arithmetic to school and home life.

Portions of these outlines are common to the needs of both sexes. Certainly both should have a knowledge of home accounting. However, the division of hand activities into home-making courses for girls and manual training and agricultural courses for boys means that the most effective correlation will be brought about by a differentiation of the arithmetic according to sex and occupational interests.

OUTLINE RELATING TO HOUSEHOLD ARTS.

1. Simple domestic bookkeeping, including daily, monthly, and yearly supplies for the kitchen.
2. Calculation of the prices of foods bought in large or in small quantities as related to the cost of meals for the home.
3. Study of the simple measurements as needed in the household, including measurements of materials used in food and clothing.
4. Cost of furnishing a kitchen, laundry, dining room, living room, and bedroom, with the expense of renovating and maintaining them.
5. Relative cost of different systems of heating and lighting; reading a gas meter.
6. General questions of maintenance of the home, including rent, water, taxes, insurance, and interest on the mortgage.

OUTLINE RELATING TO MANUAL ARTS.

1. Adding the detailed dimensions on the school sketches and drawings for the "over-all" dimensions.
2. Figuring the cost of the materials used in the article made, including the lumber, screws, stain, and varnish.
3. Working out a more elaborate cost slip of the object made; i. e., reckoning the compensation for labor, the cost of power, the interest on the money invested in the school shop, etc., as well as the bill for materials.
4. Making out a bill for the general lumber supply of the school, using the actual market prices.
5. Laying out of simple geometrical forms in wood; i. e., hexagonal taboret—calling attention to the value in degrees of the angles.
6. Proportion as applied to the speed of the wood-turning lathe, taking the speed of the motor as a basis.

OUTLINE RELATING TO AGRICULTURE.

1. Actual measurements by the class of small plots of land, calculating their area. Measurements of walls, fences, and calculating their cost.

2. Measurements of and calculating the capacity of tanks, cisterns, watering troughs, silos, storage bins, and barrels. Data may be obtained from the home equipment.

3. Special computation suited to farm practice such as income from dairy cows, feed rations, farm labor.

4. Business forms, such as inventories, time books, stock accounts, cash accounts, notes, receipts.

5. Application of percentage in study of soil composition, ratio and proportion in relation to animal feeds, practice in estimating amount of material for such spraying; i. e., emulsions, poisons, and fungicides.

6. List of materials showing cost of such farm buildings as house, barn, poultry house, corncrib.

A CITY COURSE OF STUDY.[1]

Grade 1.

SECOND HALF YEAR.

Numbers through 10: counting forward and backward; relative values of numbers which make 10; writing the names of numbers in words and figures.

Grade 2.

FIRST HALF YEAR.

All the work of this grade should be objective.

Counting by tens, fives and ones to 100; relative values of numbers within 100.

Numbers through 20: counting by twos, fours and fives. Counting backward by ones, ½. ¼, and ⅓ of numbers from 1 to 20, inclusive, which give an integer as result.

Measures used—inch and foot.

SECOND HALF YEAR.

Addition and subtraction of numbers through 14; multiplication and division through 20; writing numbers through 100; ½, ¼, and ⅓ of numbers from 1 to 20, giving an integer as result. Addition of single columns, using the combinations learned.

Measures used: Inch, foot, square inch, square foot, pint, quart.

Review very thoroughly the work of the first half year. Teach addition and subtraction of numbers through 14; multiplication and division through 20. Teach signs for all processes, using the terms *and*, *less*, *times*, *contains*, and *equals*.

Simple concrete problems should be given, using the combinations learned. The order of presentation should be: 1. Objects, in learning combinations. 2. Concrete examples (oral) with objects present. 3. Representation of combinations by figures. 4. Recalling combinations without objects; thorough memorizing of results. 5. Concrete problems without the use of objects. These problems should be very simple and based upon the child's experience. Very little written work should be required and the result should be stated in a sentence without any attempt to show the process. Readiness in finding the result of the combination of any two numbers is to be considered of first importance in this grade, because this knowledge must be at command in all succeeding stages of advancement. The addition of short columns, using only the combinations learned, gives additional practice; it is an excellent method for review.

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[1] Prepared for the schools of Indianapolis, Ind. The course as here given is necessarily much abridged.

GRADE 3.

FIRST HALF YEAR.

Addition and substraction of numbers through twenty; multiplication and division tables through fours; abstract addition, two columns; writing of numbers through one thousand; Roman notation through one hundred. Fractions, ½, ¼, and ⅓.

Measures used: Inch, foot, square inch, pint, quart, gallon.

SECOND HALF YEAR.

Addition and subtraction by "endings" through 2+9. The four fundamental processes—multiplication and division tables through fives. Multiplication and division of abstract numbers through thousands; use 2, 3, 4, and 5 as divisors. Addition and subtraction of United States money. Writing numbers through ten thousand. Roman notation through one hundred.

Application of fundamental processes to simple concrete problems of one step.

Measures used: Inch, foot, yard, square inch; pint, quart, gallon; peck, bushel; second, minute, hour, day, week, month, year. Use actual measures. In connection with the units of time, call attention to the method of telling the time of day by the clock.

GRADE 4.

FIRST HALF YEAR.

Addition and subtraction by "endings" through 4+9. Multiplication and division tables through nines. Multiplication of abstract numbers by two digits. Short division, using for divisors all numbers below 10. Addition, subtraction, and multiplication of United States money. Writing numbers through millions.

Fractions ½, ¼, and ⅛. Aliquot parts, ½, ⅓, ¼, ⅕, and ⅒, as applied to 100 only.

Measures as in Grade 3, and in addition, the ounce and pound. Use actual measures.

SECOND HALF YEAR.

Addition and subtraction by "endings" through 9+9. Multiplication by three figures. Long division. United States money, addition, subtraction, multiplication, and division.

Fractions, ½, ¼, ⅛, ⅓, and ⅙.

Pupils of this grade should become accurate and skillful in addition and subtraction of integers. Begin the work of the term by making sure that pupils can add and subtract by endings unfailingly. Subtraction by endings is especially likely to be neglected. Require pupils always to check their addition by adding the columns in reverse order. Similarly subtraction should be checked by the reverse process of addition. Thus 13 — 9 = 4, is checked by the process 9 + 4 = 13. Do not allow pupils to indicate "borrowing" by changing the digits in the minuend.

At the beginning of the term, make sure that every pupil has mastered the multiplication combinations through the tables of twelve—not only when given in serial order (9×3, 9×4, 9×5, etc.), but when selected at random (9×4, 7×9, 12×11, etc.).

Use multipliers of not more than three figures in this grade. Introduce zero into the multiplier often, as it is troublesome.

Pupils should always check multiplication by going over the work carefully, adding the partial products in the order reverse to the first addition.

It should be remembered that pupils will fail in the long division process as long as they have not mastered multiplication and subtraction.

Pupils should always check long division by going over their work carefully, using the reverse process of addition for each subtraction.

To insure mastery of the division process, after the process is acquired give a problem each day, either in long or short division, during the remainder of the term.

Mental or oral arithmetic should be given daily in abstract and concrete problems, for at least one-third of the arithmetic period.

GRADE 5.

FIRST HALF YEAR.

Review of essential processes taught in preceding grades. Long division. Reduction, addition, subtraction, and division of fractions. Aliquot parts: ½, ⅓, ⅙, ⅔, ¼, ¾, ⅛, ⅕. Mental arithmetic.

Pupils should be able automatically to add and subtract by endings and to use the multiplication combinations through 12 times 12, before beginning the fractional work. While the fractional work is being developed in class time, the written work should consist almost entirely of review problems. Enough practice should be given in long division to enable pupils to use the process accurately and fairly rapidly. Insist upon the use of short division where the divisor is less than 13.

The chief difficulty that pupils have in acquiring the fractional processes is to interpret clearly the unfamiliar, and so perplexing forms and terms used. The problem of the teacher therefore is to enable pupils to interpret these conventional symbols into terms of their own experience. To this end pupils should first learn to objectify the common fractional quantities, halves, thirds, fourths, sixths, eighths, and twelfths. Pupils should compare these fractional parts when applied to actual objects (oranges, apples, sheets of paper, etc.), and to representations of objects by drawings. Drawings should be used very largely for objective development in this grade, as they make possible a much wider application of the fractional parts than would be possible with a few objects. The drawing, moreover, is the natural step between the object and the abstract symbol. Whenever a drawing is used the child should think of it as representing some definite object.

Mixed numbers, proper and improper fractions.—Develop these terms objectively by paper folding or from drawings. Pupils at first read a mixed number, 2⅔, as 2 whole and ⅔ of a whole. They should realize that an improper fraction is equivalent to a mixed number with the wholes cut into the same sized parts as those indicated by the fraction and all of these parts combined.

Reduction.—Pupils should now specialize in the following processes until they are skillful in the use of them, approaching each from the objective point of view.

a. Reduction of integers and mixed numbers to fractions.

b. Reduction of improper fractions to integers or mixed numbers.

c. Reduction of fractions to higher and lower terms. The work in this last topic should be especially thorough, as addition, subtraction, and division of fractions usually involve one or both processes.

Addition, subtraction, and division of fractions.—Pupils that have had the above preparation will have no difficulty in acquiring skill in the use of these processes if abundant practice be given. It should be recognized that the business world seldom deals with fractions whose denominators are higher than 16, preferring to use decimals for all such fractions. This should cause the teacher to drill largely upon fractions of the larger denominations (with small denominators).

Finding the least common denominator (by inspection only) should be taught. Denominators too large for this method should not be used.

SECOND HALF YEAR.

Review of preceding essential processes. Multiplication of fractions. Addition, subtraction, and division of decimals. Aliquot parts: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{5}{6}$, $\frac{1}{8}$, $\frac{3}{8}$. $\frac{5}{8}$, $\frac{1}{12}$, $\frac{1}{16}$. Mental arithmetic.

Make clear to pupils that a fraction may be expressed in a variety of ways: (1) Five hundredths; (2) 5 hundredths; (3) $\frac{5}{100}$; (4) .05.

The last way is called the decimal form, because it is used only to express fractions whose denominator is ten or a multiple of ten.

At this point lead pupils to see that a fraction has two meanings:

First. The meaning that they, as primary school children, were taught to attach to it—namely, that a fraction expresses a certain number of equal parts of a unit.

Second. The meaning that the mathematician often attaches to it—namely, that a fraction is an expression of division, in which the numerator is the dividend and the denominator is the divisor.

GRADE 6.

FIRST HALF YEAR.

Review of essentials. Multiplication of decimals. Percentage, first case. Denominate numbers and measurements. Bills and receipts. Mental arithmetic.

Teachers should, at the outset, determine which pupils can not add and subtract readily and use the multiplication combinations automatically, and assist them to overcome these fundamental weaknesses. The first two or three weeks should be used in a thorough review of the essential processes. Teachers should, throughout the term, emphasize the work in all the decimal processes so that the pupils may acquire skill in the use of them before leaving the grade.

In this grade give only the first view of percentage. For this reason confine the work to an explanation of the way of reading and writing per cents, to teaching the connection between per cents and integers, and to finding given per cents of numbers. Keep the work simple, using only whole numbers of per cents. For example, use 4%, 5%, 6%, etc., but not $4\frac{1}{2}$%, $6\frac{2}{3}$%, etc., in this grade. Some suggestions:

(*a*) Teach percentage as a phase of multiplication of decimals.

(*b*) Teach the idea of per cent by finding, orally and in writing, hundredths of given numbers, expressing the written work at first by the common and then by the decimal form of the fraction. After the pupils have a clear idea of finding hundredths of a number decimally, give them the percentage form of notation and expression; i. e., tell them that 0.05 is written 5%, etc. They should learn to associate hundredths and per cents.

(*c*) Give the pupils wide experience in changing decimals to per cents and per cents to decimals, using integral numbers of hundredths.

(*d*) Give the pupils wide experience in finding by the decimal process a given per cent of a given number. Do not introduce during this term the difficulty of deciding whether or not to use the common fraction or the decimal fraction equivalent of a given per cent; that is, use always the decimal fractions.

Denominate numbers and measurements should receive a thorough treatment in a practical way in this grade. Teach the necessary tables of denominate numbers. Some of these tables the pupils already know, whereas others they will now meet for the first time.

(*a*) The pupils should memorize thoroughly these tables, excepting that every item which modern business does not require the average man to know should be excluded; more definitely teach the following tables: time, weight, dry measure, liquid measure, linear measure, square measure, and cubic measure.

Ask the pupils to bring to school bills that have been used in business transactions. Talk them over with the class, showing the advantage of the conventional forms of ruling, heading, receipting, etc. The pupils should be asked to make out bills first on blank forms, if they can be obtained, afterwards on paper which they have ruled themselves. Let their imagination be used to make these business transactions represent actual transactions as far as possible. Let it be imagined or represented that the teacher or one of the members of the class has sold the rest of the class a bill of goods or done a piece of work for them, or rented a house to them. The resulting bill should contain the real names of the parties to the transactions. The pupils should learn how to receipt a bill properly and also how to give a receipt for any obligation; that is, an account settled, rent paid, wages received, and part-payment receipt.

All processes and subjects taught in this grade should be introduced by simple work given orally. After a principle has been taught a large number of simple exercises should be given in mental arithmetic, so that the pupils can become sure and skillful in the application of the process. Mental arithmetic should be given daily for one-third of the recitation period.

SECOND HALF YEAR.

Review of all essential processes previously taught, as follows:

(*a*) Addition and multiplication combinations.

(*b*) Notation and numeration of integers, Arabic and Roman; fractions, common and decimal.

(*c*) Reduction. Changing denominate numbers to higher and lower denominations; a common and decimal fraction to higher and lower terms; changing mixed numbers to improper fractions, and the reverse process; changing decimals into common fractions and common fractions into decimals.

(*d*) Addition, subtraction, multiplication, and division of integers; common and decimal fractions; denominate numbers.

(*e*) The use of the common aliquot parts.

Percentage.

Measurements.

Simple bills, accounts, and receipts.

Mental arithmetic.

The purpose of the review work in this grade is to establish a strong foundation for future mathematical study by making pupils sure and skillful in the use of the essential processes previously studied, and by revealing to them the unity of the subject as based upon the two general underlying principles.

At the outset the teacher should make sure that every pupil can add and subtract accurately and use the multiplication combinations automatically. All cases of "arrested development"—such as counting in adding, adding instead of using the multiplication combinations, and writing down numbers to be added to the next higher order in multiplication—should be earnestly sought out and corrected. The teacher, particularly of this grade, should feel that unless this fundamental work is thoroughly accomplished her work in arithmetic is, to a considerable extent, a failure.

Pupils should now be able to read and write the quantities, appearing under various forms, which they will need to use. They will probably have no difficulty with common fractions and denominate numbers, but they may need considerable drill in integers, Arabic and Roman, and in decimals. Their knowledge of the Roman system will be used almost exclusively in connection with the numbering of chapters in books, and it should be taught with this in view. Drill only upon numbers below C.

In the decimal notation considerable drill may be necessary before the pupils will readily associate the name of the order with the number of decimal places.

Sufficient drill should be given to enable pupils to reduce denominate numbers to higher and lower denominations and to give them proficiency in changing fractions to other fractional forms; common and decimal fractions to higher and lower terms; improper fractions to mixed numbers, etc.

It should be the aim of the teacher to keep the percentage work entirely on the thought side, avoiding all formulas or rules. The work includes the relation between common fractions, decimals, and per cents; the finding of a given per cent of a number; the finding of a number when a part is given; and the finding what part one number is of another.

"Gain and loss" should not be taught as an independent topic, for the problems which come under this head can be classified with the three kinds of percentage problems mentioned above. If it is clearly established with the child, by means of blocks or by representation by drawings, that the selling price is always made up of the cost with a part of itself added or taken away, according as there has been a gain or a loss, he will have no difficulty with these problems.

In connection with the percentage work, pupils should acquire facility in the use of the common aliquot parts. Those that are easily computed (as $\frac{3}{5}$=60%) should not be committed to memory, neither should those that are not commonly used (as $\frac{5}{16}$=31¼%). Pupils should learn, however, to compute quickly the decimal equivalent of any fraction, by expressing the numerator as a decimal and dividing by the denominator. An excellent drill consists in counting by fractional parts, giving at the same time the decimal or per cent equivalents.

In measurements, review the work with the rectangle, square, triangle, cube, distinguishing them from each other and associating these geometrical names with the figure already familiar.

The problems under this head should be practical. Require pupils frequently to make their own measurements in order to obtain the conditions of the problems they are to solve. Illustration: Find the dimensions of your schoolroom. What is the total area of the walls and ceiling? How much window surface? How much blackboard surface? Determine the cost of sodding the yard of your school and inclosing the school yard with a fence.

One good way of treating this topic is to work out problems in connection with building and equipping a house or the school building. If a building is being erected in the neighborhood, it should be used for this work in order that the problems may be real.

In order to train pupils to keep simple accounts—an accomplishment that everyone should possess—teachers are requested to have at least one exercise a week in which the children make a record of their income and expenses. This exercise need not occupy an entire period. Except when class instruction is needed, the records may be made before school, or at odd times.

The accounts should be of actual moneys belonging to the pupils, if that is possible. It is better to have a briefer account and have it a real one than to fill it with fanciful transactions or family transactions. The accounts should indicate briefly, but adequately, the sources and dispositions of income; not Rec. from Aunt Mary, but Gift from Aunt Mary; not Paid out, but Paid for candy; not Earned, but Shoveling snow, etc. The headings at the top of the pages should be uniform through each book—either Received—Paid, or Income—Outgo, or Receipts—Payments. Balances should be computed at the close of each month. These balances should be properly brought down by use of red lines, if possible, and carried forward to the next month's account. Begin each month on two new pages, with proper statements of amounts brought forward from previous month. Have a uniform use of capitals and punctuation. Pupils may keep memorandum slips, but entries in the account books should be made in school, with ink, and accounts should not be copied. Accounts through vacations should be kept in memorandum form and entered in the books in school after vacation. The accounts will be opened October 1 and February 1 and be continued through the 6A grade only, including vacations. Account books will be furnished this grade.

Ask the pupils to bring to school bills that have been used in business transactions. This work is review, and pupils should become proficient in making and receipting bills of various sorts that are used in the common business of life. Make the work practical, and frequently during the term give practice in this work.

All processes and subjects taught in this grade should be introduced by simple work given orally. After a principle has been taught a large number of simple problems should be given in mental arithmetic exercises, so that the pupils may become sure and skillful in the application of the principle. Mental arithmetic should be given daily for about one-third of the recitation period.

GRADE 7.

FIRST HALF YEAR.

Review of essential processes. Applications of percentage (commercial discount, commission, taxes, simple interest). Constructional geometry. Mental arithmetic.

First make sure that all pupils can use the fundamental processes skillfully. If weaknesses are revealed, test for addition endings and multiplication combinations and follow up all deficiencies until they are overcome.

Devote the first two or three weeks—more or less, according to the class—to a review of the essential processes. It is only when a good foundation is established in this review work that the best results in the advance work can be assured.

Do not allow pupils to become confused by the new terminology found in the applications of percentage to various kinds of business. Cause them to see that these involve the identical principles and processes which they used in their study of percentage in the preceding grades. Keep the work simple, practical, and in accordance with present business methods. Train pupils to investigate by polite and pointed inquiries the different kinds of business studied. The information thus gained should be reported to the class in an interesting and profitable manner.

The subject of commercial discount is of great value because of its extensive use "from wholesale transactions down to bargain sales." Pupils should understand some of the reasons for allowing discounts. Buying in large quantities, paying "cash down" or within a specified time, the usual deductions from list prices, etc. It would be well, for obvious reasons, to review bills and receipts in connection with the study of this topic.

Let the pupils interview commission merchants and obtain conditions for some practical problems, and, at the same time, a social interest in this important business. Eliminate all problems that state that the sum of money sent includes the commission and the price of the goods bought, as this is contrary to business practice.

The subject of taxes should be treated briefly. It should be shown that there is expense involved in conducting the affairs of a city. To make this concrete, use as an illustration the fact that the public schools are dependent upon the taxpayers for their support. Point out the necessity of each citizen paying his rightful share of the public expenses of government. The simple mathematical work in the subject may be developed by the analogy between levying a city tax and taxing the members of a ball team to meet its expenses. The attempt in the former case to apportion the taxes, according to the individual's property, may be brought out by the contrast in this respect between these two illustrations of taxation.

Confine the work in this grade to the subject of municipal taxes, discussing the subject only in a simple way. Use the current tax rate in problems.

Present conditions so that the child can discover that interest is merely a form of percentage with the time element introduced.

One arithmetic period each week should be devoted tc the geometry work. The purpose of the work is to teach pupils to use the few mechanical drawing instruments which they buy, and to acquaint them with some of the essential fundamental terms and principles of geometry.

SECOND HALF YEAR.

Review of essential processes.

Problems of the home. Grocery, meat market, department store problems. Making change. Cost of heating and lighting the home. Cost of furnishings for the home. Other problems relating to the cost of food, heat, light, clothing, etc., for the family.

Saving and investing money. Saving money. Investing money. Banking. Interest. Real estate. Loans.

Constructional geometry.

Mental arithmetic.

In the problems for the home this city provides data in a pamphlet on community arithmetic.

These problems are designed to give drill upon the essential processes through the use of such problems as are met by individuals in their daily life. They are to be solved upon the basis of current prices in every case. For this reason it is important that the teacher should get in advance a list of the items, together with the current prices. These problems are the kind all of us as purchasers should be prepared to solve mentally, or if not so, then in writing with very brief notes; they are the kind that salesmen and clerks are called upon to solve in their daily work. The problems will be found useful for both mental drill and for written lessons.

The department-store problems are designed to meet the criticism of store men that both clerks and the public are unskillful in the solution of such simple problems as occur in the conduct of a department store.

Give problems showing that small daily and weekly savings will amount to large sums in time; that money may often be saved by making cash payments rather than paying by installments or buying on credit; that it is more economical to buy in reasonably large quantities; that the cheapest things are sometimes the most expensive in the long run.

Consider the various ways of investing money: Banks and trust companies; real estate; loaning money. Establish the economic principle that the higher the rate of interest offered by an investment, the greater the risk involved; also, that the element of safety in investments is of far greater importance than the amount of income from them.

The bank is the most commonly used means provided for the safe-keeping of money. Certain kinds of banks—for instance, savings banks and trust companies—not only guarantee to take care of all money left with them by depositors but they also pay a certain per cent of interest.

When practicable, pupils should go to a bank and ask some official to show them about the bank. Report what you learn to the class. Ascertain what officials there are in the bank, and the duties of each.

Many schools have found it interesting and profitable to organize school banks, electing the officers and carrying on a regular banking business, either with small amounts of real money placed on deposit by pupils and transferred by the teacher to some bank or trust company, or with imitation money, which can be made by cutting out rectangular pieces of paper for bills and circular pieces for coins, marking on each piece its denomination.

Teach the method of depositing money, of drawing checks, of borrowing money, and of discounting notes.

Not less than one arithmetic period a week should be devoted to the geometry work. The purpose of the work is to teach pupils to use the few mechanical drawing instruments which they buy and to acquaint them with some of the essential fundamental terms and principles of geometry.

The aim of each exercise should be clearly stated to the pupils and they should be led, so far as practicable, to think the successive steps to the conclusion. In other words, make it a thinking exercise rather than a mere dictation exercise. Encourage pupils to use their instruments as much as possible in the mensuration work in arithmetic, in the art work and manual training work, and whenever they will be serviceable.

GRADE 8.

FIRST HALF YEAR.

Review of essentials.

Problems relating to the industries of the city and State. Manufacturing interests of Indianapolis. Manufacturing interests of Indiana. Problems met in certain lines of work; some railroad problems; foundry problems; problems of buying and selling paper; making out a pay roll.

Paying and collecting money by checks, drafts, and money orders.

Generalized arithmetic and equations.

Proportion.

Mental arithmetic.

Instead of the above, the Latin classes take algebra; however, in these classes also, drill in the previous arithmetic work so as to maintain efficiency.

In the eighth grade, problems relating to the interests of the city are prepared and are issued in pamphlet form.

SECOND HALF YEAR.

Review of essentials.

Generalized arithmetic and equations.

Stocks and bonds.

Insurance—fire, life and accident.

Cost and support of our Government. Cost of city schools. Cost of city government. Money raised by taxes. Money raised by sale of bonds. Money raised by special assessment.

In treating of stocks and bonds show that a great deal of the wealth of the country is invested in the various kinds of business which supply our wants and minister to our welfare. Name a number of the business enterprises in or near your community which are owned and controlled by single individuals; a number in which more than one person have invested their money. Show that much of the business of the country is now carried on by these corporations—for instance, railroads, trolley systems, and many of the large manufactories. The money contributed to carry on these industries is represented by bonds or certificates of stock, which are bought and sold like land or merchandise. Explain the fluctuation of stocks and the difference between stocks and bonds.

Pupils can find the market price of the more common stocks and bonds quoted in the daily newspapers, and while studying this subject they should follow these quotations from day to day. Explain the abbreviation "pfd." (preferred), and the difference between preferred and common stock. Most railroads and many other business enterprises issue these three forms of securities—bonds, preferred and common stock. Pupils should study these different forms of securities as issued by some local corporation, as a traction company or railroad.

The work in stocks and bonds will be limited to the finding of the cost of a given number of shares of stock or of a given number of bonds, at a given market price, and to the finding of the income from a given number of shares of stock or a given number of bonds.

Insurance should be studied for its informational rather than its mathematical value. Three kinds of insurance should be briefly and simply discussed—life, accident, and fire.

Pupils should understand the underlying principle in insurance; paying a relatively small, but carefully estimated sum of money to a company for their guarantee to pay a very much larger sum of money in case of a specified contingency.

They should understand the following terms: Policy, premium; "straight life" and "endowment" policies; "good" and "poor" risks.

The problems in the cost and support of the Government should be designed to maintain and increase efficiency in the essential processes of arithmetic through constant application and to convey information concerning matters of local or national interest, of which all citizens should have some knowledge. This aspect of the work is designed to correlate with the work of the civics class. The problems should afford opportunity for the use of the four fundamental operations with integers, percentage, and some of its applications.

SUBCOMMITTEE 2. MATHEMATICS IN THE KINDERGARTEN.

In the early history of the kindergarten as an educational movement, there was a somewhat unanimous opinion current regarding the direct mathematical training and the instructions to be given to the children through concrete experiences with Frœbel's educational materials.

The gifts and occupations (the technical names given to Frœbel's play materials) form a related series planned to meet the creative and constructive impulses of the child, through activities involving the analysis and synthesis of geometric forms. The gifts begin with the ball (sphere), the cube, and the cylinder, progressing through the analysis of these to the study of surfaces, lines, and points. The occupations are based upon such activities as perforating, sewing, drawing, weaving, the folding and cutting of paper, and modeling. They reverse the geometric evolution, embodying the synthesis of form from the point, through lines and surfaces, back to the solid.

The traditional method of using these materials in the early history of the kindergarten tended toward a much more direct process of instruction, bringing to the children a consciousness of the geometric relations embodied in the gifts and occupations.

As the modern primary school reduced the amount of conscious arithmetical knowledge and instruction in the course of study for the younger children, a parallel movement took place in the kindergarten. As a consequence, the more direct method of mathematical instruction, which the geometric basis of the Frœbelian materials made possible, gradually gave place to a more indirect approach to number, measurements, and geometric relations, through a more incidental, organic, and fundamental emphasis upon these aspects of the materials in the moral activities of work and play.

The present tendency seems to point toward a valuation of the mathematical possibilities of the Frœbelian materials as means to a higher end; that is, as structural, functional, or organic means necessary to realize the playful, the creative, or constructive impulses of the child through which these mathematical values may begin to come to consciousness.

The fact that the Frœbelian gifts and occupations are based upon a geometric analysis and synthesis of form, need not reduce or interfere with their creative and playful opportunities, except in the hands of a kindergartner who clings to the formal use of them as a means of direct mathematical instruction. On the other hand, the very fact that their structure and use involve such unconscious activities as counting, addition, subtraction, multiplication, and division, some consciousness of these mental processes and their results will gradually come to the child whether the teacher emphasizes or ignores them.

The very nature of the material familiarizes the child, through playful concrete experiences, with the mental processes involved in the solution of problems in fractions and all the elementary activities of mathematics which may be brought to consciousness later through the more direct methods of instruction in the elementary school. To what degree the mathematical values involved in these playful activities should be brought to consciousness at the kindergarten period, is still under discussion, with much less decided differences of opinion than would have been apparent five or ten years ago.

While the structural and functional use of the activities of counting, measuring, adding, subtracting, and dividing seems to be on the increase, there is an equally evident growth in the appreciating of the fact that they must not be left to chance experience without due attention to ways and means for providing opportunities for further progress. In other words, there is a decided feeling that in mathematical experiences, as with all others in the kindergarten, the teacher must provide conditions which insure steady progress from the simple to the more complex, from the unconscious activities involving mathematical values to the more conscious abstraction of these, and to a continuous growth in the appreciation and control of the mathematical possibilities which are normal to the child at this period.

As a knowledge of mathematics in some form underlies all industrial activities of mankind and in the foundation of all true proportion in the art world, the kindergarten brings the child to a gradual consciousness of numerical and geometric relations, the former by such features as simple counting, measuring, and adding, as his work and play may demand, and the latter by the use of the geometric gifts and not by abstract exercises. In this way the younger children get arithmetical and geometric impressions incidentally, and the older children come into a more definite knowledge of mathematical relations, and thus begin an intelligent mastery of the material world.

The kindergarten which represents the progressive school makes no attempt to teach mathematics in a formal or direct way, since the child of kindergarten age is not interested in and can not grasp anything so abstract as number or geometric form apart from the use he may need to make of each in carrying on his play activities successfully. But in his experimenting and play with different materials he discovers certain facts in regard to number and special relations; for example, that if he uses four of his eight building blocks to make a square table, he has four left to use as chairs. Later he will make use of the knowledge thus gained, and will acquire further knowledge of the same sort in his efforts to carry out his ideas and purposes.

Often the hand work requires the division of material into halves, quarters, etc., or some material needs to be measured and cut to fit. Through such experiences the child acquires a working knowledge of certain satisfactory methods of dividing and measuring material. Furthermore, he becomes familiar with a number of geometric solids through using them in building, and he learns to select the kind that will best express his idea. The same is true of his work with paper cut in the form of squares, circles, and triangles. The games sometimes call for the grouping of children in threes or fours, and there are many occasions when counting is advantageous. The child in the kindergarten thus gains considerable knowledge which may be termed mathematical. Such knowledge comes at first incidentally and unconsciously through play, and later as the result of conscious efforts to reach ends which appeal to him as valuable.

After due investigation an effort was made by this committee to arrive at some conclusion regarding the amount of mathematical knowledge which kindergarten children could acquire, without direct instruction, through the normal activities of work and play. As a result the committee has agreed upon the following:

(1) Ability to count up to 35 or 40 can be secured through the children's helping to keep the daily record of attendance.

(2) Ability to know and name correctly the sphere, cube, and cylinder, and the most characteristic surface forms such as circles, squares, rectangles, and the right triangles.

(3) Ability to know groups of objects up to five or six.

(4) Ability to know, construct, and use intelligently halves, thirds, and quarters, by the help of blocks and the kindergarten occupations.

(5) Ability to add, subtract, divide, and multiply small numbers through constructive play. For example: (*a*) 2+2, 2+3, 2+4, 3+3, 3+4, 4+4, 5+5; (*b*) 2×2, 2×3, 2×4. (*c*) 4—2, 6—3, 8—4.

As to method, the committee calls attention to the following points:

(*a*) The concreteness of the work.

(*b*) The work is functional and structural, as means to an end, through the activities of work and play.

(*c*) Knowledge is acquired through self-active experience.

(*d*) In an incidental but not accidental fashion, as a result of definitely planning the experiences which involve steady progress in the use and control of mathematical facts, the child comes to realize ends that are of worth and interest.

That a better knowledge of the child is leading to a greater unanimity of opinion is quite evident from this report, since it is prepared by members who were selected because they were supposed to represent widely different points of view that obtained a few years since.

SUBCOMMITTEE 3. MATHEMATICS IN GRADES ONE TO SIX.

I. INTRODUCTION.

As four definite topics were assigned the committee, it was agreed to divide them among the four members other than the chairman, so that each could do intensive work on one topic. The chairman was thus left the task of checking each by doing extensive work in all the fields designated. The topics were consequently assigned as follows:

Topic a.—The organization of schools and the general relation of each kind of school to the others.—Miss Julia Martin, Howard University, Washington, D. C.

Topic b.—The mathematical curriculum in each type of school.—Miss Harriet Peet, State Normal School, Salem, Mass.

Topic c.—The question of examinations from the point of view of the school.—Dr. C. W. Stone, State Normal School, Farmville, Va.

Topic d.—The methods employed in teaching mathematics.—Prof. Henry Suzzallo, Teachers College, Columbia University, New York City.

The reports on these topics naturally overlap in certain investigations. As originally prepared they contained numerous graphs and statistical tables, embodying many scientific data, and only the exigencies of publication prevent their appearing in complete form. All have necessarily been condensed for present publication.

The chairman gathered her data in narrower fields, but in the same way as did her colleagues, namely, by—

(1) Personal conferences during eight months with hundreds of teachers, met at institutes and in conventions, at teachers' meetings and study clubs. (2) Correspondence with teacher friends in almost every section of the United States. (3) Study of text books and manuals in mathematics, published during every decade since 1860. (4) Study of methods in mathematics as given in all forms of pedagogical writings during the last 50 years. (5) Examination of courses of study issued by four State departments, five State normal schools, six city systems, and five private schools. (6) Testing several fifth grades in one city by means of Dr. Stone's "standardized tests." (7) A careful study of examination questions issued by teachers, superintendents, and State departments. (8) A questionnaire given to about 300 normal-school students.

The questionnaire was formulated to secure evidence on topics *b*, *c*, and *d*. Plainly, during the last 10 to 15 years (when the students questioned were in grades one to six) arithmetic grew yearly a more vital part of the course of study, being "the subject most emphasized," being most often "the subject governing promotion," and being the subject in which the majority of the so-called "brightest" pupils "excelled."

The course of study as recalled limits the fundamental operations applied to both integers and fractions, leaving all "extras" to the seventh and eighth grades. One interesting fact was the great uniformity in distribution of arithmetic topics; the students questioned had had their early training in at least 10 different States, and in no less than 100 different schools.

On the question of examination over 87 per cent had to take examinations, the majority taking them either monthly or semiannually. In general the examination counted for one-third to one-half of a pupil's promotion average. Eighty-two per cent objected to examinations, usually because the student was "nervous," "worried," "afraid," or filled with "dread," but occasionally because the test seemed unfair or caused cheating.

These same students imagine (in a few cases only they "know") that only 78 per cent of the teachers favored examinations, fully one-third of this number favoring them only because "it was a duty to be met." At least 22 per cent of teachers are thought to object to examinations.

The questionnaire gave little help on the question of change in methods, since students were plainly influenced by very recent work, or else could not write out the explanations they had once had. Ratio work was evidently little understood, students almost invariably using one as the only basis of comparison. If they had ratio work since they left the intermediate grades, it must have appeared so difficult that they think young pupils should still be taught the to them easier or simpler way of returning to one each time.

The chairman made her report in full before the individual reports were received (or, at any rate, opened), so that the unanimity of opinion as to present conditions and marked tendencies in the teaching of mathematics displayed in the five separate reports prepared at great distance from one another, based upon different sources of information, and frequently overlapping, gives one confidence in the validity of the results indicated.

In recasting the whole for publication, extra effort was given to eliminating whatever did not bear directly upon the topic of mathematics as taught in grades one to six of the general elementary schools, public and private.

TOPIC A: THE ORGANIZATION OF SCHOOLS AND THE GENERAL RELATION OF EACH KIND OF SCHOOL TO THE OTHERS.

A fair degree of uniformity marks the organization of schools in the different States of the Union, only such variations being noticeable as would naturally come from difference in (*a*) age of the settled territory, (*b*) density of population, and (*c*) inherited ideals.

First, we note two large classes of schools, public and private. The first group naturally divides again into three subdivisions, namely—

(*a*) Those found in rural communities, and called "ungraded schools," "country schools," "rural schools," "district schools," or "parish schools," according to the locality and the educational system. As rural communities increase their wealth, their ambition for educational advantages, and their interest in educational problems, new forms of these rural schools come into existence, called "semi-graded schools," "consolidated district schools," "township high schools," etc.

(*b*) So-called "graded schools," found in smaller as well as in large cities. Such a city system usually consists of an "elementary school"—eight years of work, divided into primary, including kindergarten if given, intermediate, and grammar grades—and a "secondary school" or "high school."

(*c*) Those schools which the State or Government at large supports, the only ones of these which include grades one to six being (1) schools for abnormal and indigent children and (2) elementary schools in connection with normal schools and with such State universities as have a department of education and maintain a "practice school."

The relationship between these subclasses of public schools is very slight, rural schools being largely autocratic, in spite of existing school boards and county superintendents, whereas graded systems, also (nominally) under the jurisdiction of the county superintendent, are in smaller cities much more democratic, though perhaps plutocratic in large cities where specialists supervise the work, while schools of the third class might, in a similar way, be denominated as bureaucratic. Of course, schools for defectives, incorrigibles, etc., do not pretend to employ the same materials of education nor the same standards of scholarship as do the other classes of schools. Theoretically, if not actually, normal school and university "model schools" establish the standards for their State. They are organized to further a threefold function: (1) "Model" instruction for pupils attending, (2) opportunities for practice in teaching by the students of the main school, and (3) opportunities for testing out theories of education by professors of the different departments. Different schools may emphasize one or the other of these functions, but the three are still ever present. Because of the relationship between these functions, the curricula, the grading or organization, and the methods of instruction employed in a normal school, for example, are usually submitted to the faculty for discussion, so that the result represents a "cabinet" conclusion, and therefore is authoritative; usually, though not always, being adopted by other schools of the State.

Specialists who supervise the work in large cities have not the help of such discussions and must grow somewhat autocratic in the selection of subject matter and of method, the system being too large for them to get the expression of teachers in the same way that a superintendent may in a smaller city where all of the teachers know all the phases of work and so feel freer to express their opinions.

The rural school is organized with one teacher for all grades and for all subjects, with many classes to be heard daily and with long periods between recitations for each individual pupil. The county superintendent, with large territory to cover and with bad roads and inclement weather to work against, sees the teacher very seldom; the directors are inclined to visit the school still less frequently than does the county superintendent; so that the rural teacher is truly absolute monarch in his dominion, and, if he profits by his own mistakes, there is no better training for any teacher than just this independent battling with the problems of the professions.

A glance at the second class of schools, those not supported by public funds, reveals very few schools which contain grades one to six. In the United States comparatively few parents send either boys or or girls away from home to school before they are 12 or 14 years of age, so that most preparatory departments in academies, colleges, etc., begin with work ranking in difficulty with that done somewhere from the sixth to the eighth grade. Some technical schools, trade and night schools, a few philanthropic schools like those of the Educational Alliance in New York and Hull House in Chicago, and some private schools like the Lower Shattuck (Faribault, Minn.), and the Horace Mann and Ethical Culture Schools of New York City, contain all the lower grades and deserve our study, but as these schools usually form no part of a "system," each stands alone in its organization, and consequently in its curriculum, both being largely based upon the aim which actuated the founding of the school.

TOPIC B: THE MATHEMATICAL CURRICULUM IN EACH TYPE OF SCHOOL.

Rural schools have the reputation of doing a greater amount of mathematics in grades one to six than other classes of schools, and though the studies made for this paper gave no proof of this, it may well be true, for such a result would be the natural outgrowth of (1) the old-time emphasis upon mathematics as a test of "brightness;" (2) the consequent selection of teachers (the "brightest" students of a community) good in mathematics, so that they probably taught this science better than they did other subjects, or, if not, they at least continued the emphasis upon it; and (3) the organization of the rural school, with its one teacher, many classes, and much necessary seat work or independent study. Since assignments in mathematics could be easily made and most easily corrected, since to have "ciphered through the book" was a mark of distinction, and since pupils who had any ambition to attain this distinction could thus be kept "in order" for long periods, mathematics came to form a major part of the curriculum of the rural school. Prof. W. S. Smiley's statement[1] that rural pupils are superior to urban pupils is of interest here, even though it deals with eighth-grade pupils, and probably contains some error in comparisons.

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[1] Journal of Educational Psychology, vol. 1, no. 9.

The graded school, with the necessity for meeting the wider and more varied interests of the city, naturally feels that other subjects must be given equal prominence with mathematics. The organization of the work usually permits one teacher to have a single grade, with two or at most three divisions in a room, so that long study periods are unnecessary. These two influences tend to make mathematics less prominent in city systems than in the rural districts. Changes in method, usually first adopted by city systems, also contribute to changes in the mathematical curriculum, so that we usually find graded-school curricula placing mathematical topics from one to two years farther up the grades than do rural schools. One influence that has been strongly felt in this postponement of difficult subject matter is that of the kindergarten, comparatively recently made a part of public primary education, it having begun as an independent factor. Before this, the tendency had been to push subjects lower and lower into the grades to meet the demands of the secondary school which in turn was dictated to by college and university. Out of the conflict which naturally ensued there has arisen much earnest thought and discussion over the mathematical curriculum of the common school, no decision as yet being reached. Nevertheless, through examination of courses of study and through the returns from some questions propounded to normal-school students, it appears that within a small range of variation the schools of the United States have fallen into a fairly uniform course of study in arithmetic.

A study of textbooks in common use shows a very marked change throughout the course in the sort of problems given as means of applying these fundamental operations. The latest and best arithmetics choose material closely related to daily life, so that children can not fail to feel a greater and more reasonable need of the mechanics of mathematics—a more "rational motivation" for the subject than pupils of the past could ever have felt.

TOPIC C: THE QUESTION OF EXAMINATIONS FROM THE POINT OF VIEW OF THE SCHOOL.

The writer's report on this topic is less valuable than on the others, because (1) the topic seemed difficult of interpretation, (2) the questionnaire given failed to limit the question to examinations in mathematics, and (3) the student's answers about time spent, etc., proved unusable.

To get the view of "the school" it was decided that one must know (1) the view of teachers, both from their own and their pupils' standpoints, and (2) the view of superintendent and supervisors whenever such view proved more representative of the "school's" attitude than did the feeling of the teachers. Finally, the report is based upon very limited resources, viz: (*a*) The study of a few books or chapters dealing with the reasons for giving examinations, (*b*) an inspection of some examination questions given by different schools and State departments of education, (*c*) the giving of Dr. C. W. Stone's tests to a number of classes, and (*d*) such general information as a teacher naturally acquires during several years' experience.

Even to the present time examinations have been ranked most highly, but for different reasons by different schools. Some feel that the value lies in the mark obtained by the pupil, this mark being made a definite test of his ability, and upon it depending very largely his rank in class and his readiness for promotion. This belief causes great stress to be laid on "finals." Others deem the practice in organizing quickly, in thinking clearly, and in expressing accurately to be the main value of examinations. This theory tends to the use of monthly or biweekly examinations. Still other schools find the worth of examinations to lie not in a benefit to the pupils (save indirectly), but to the teacher, giving her, as they do, opportunities to check objectively her subjective ranking of pupils and of class progress. In this case, the examination papers are never returned to pupils, the teacher merely noting errors on which to work with both class and individuals. Yet other schools stand strongly for more or less frequent examinations, because of the chance this gives the superintendent to check the results obtained by different teachers, and to locate the cause of any unusual divergence from the norm, whether the cause lie in the teacher, in the pupil body, or in the course of study. Other reasons are advanced, but these are sufficient to illustrate their variance.

The present attitude and seeming future tendency concerning examinations is to rank them as valuable, but to let the value, and the consequent use made of the papers, be controlled wholly by the aim. The benefit to the pupils arises largely through practice (1) in separating essentials from nonessentials; (2) in clarifying a viewpoint through the enforced expression of it, or perhaps through its defense; (3) in learning to interpret the printed or written page independently, i. e., without the teacher's voice or eye or gesture to guide; or (4) in merely being tested upon memorized facts, which, though not the most vital thing in education, are yet the basis for all comparing, relating, and judging that are to follow. With this aim the tests should be frequent, should be carefully looked over by the teacher, and very soon thereafter should be made the basis of further class or individual instruction.

One proof that the first three forms of practice are growing in importance to teachers is found in the very different sorts of questions asked to-day from those of a decade or more ago. The earlier purely memoriter questions are giving place to those which require old knowledge, not as isolated bits, but as knowledge to be utilized in new situations, to be marshaled quickly at will, and arranged logically, i. e., to questions which demand thought, judgment, choice, defense of opinion, etc.

Those tests, examinations, or parts of examinations whose purpose is to help the teacher check her judgment of pupils and test the portions of subject matter taught as to their relative value in giving the pupil ideals of and practice in persistence, honesty, independent thought-power, etc., need not be returned to the pupils. Though the teacher seems by this means to be saved considerable labor in checking errors, attempting to grade each paper justly, etc., the conscientious teacher has still the task of noting errors and classifying them in various ways; for example, errors due to ignorance or to carelessness; those relatively important or unimportant; class or individual errors; errors to be immediately dealt with or those which may better be handled each time an opportunity offers and so must be kept constantly in mind.

Were the correcting not so burdensome, many teachers would increase rather than decrease the frequency of examinations, especially if the time could be set and the questions made out by the teachers themselves. The greatest complaint about examinations comes from teachers who feel strongly that questions made out by any other person than the teacher of the children tend to become of the mechanical or memoriter type. Particularly is this resented when questions have so become, and when no latitude is given either pupils or teachers, i. e., when no account (in a large system) is taken of the personal equation, and when teachers and pupils are measured by these tests alone. As superintendents and supervisors make broader studies in these fields, they recognize the need of allowing for individual differences and the cause of the above complaint is fast disappearing. Without doubt a movement in the right direction is being made by Dr. Stone and others who are working out standardized tests, and it is hoped that this work will continue, being constantly improved and made more far-reaching in its effect. That superintendents find the returns as valuable in checking up their teachers as teachers do in checking up their pupils must be recognized by all.

To summarize, then, little change is seen in the value placed upon examinations; but marked changes are occurring in the type of the questions. The formal, lengthy, memoriter type which counted much in promotion and class ranking is rapidly changing to the type which is only another means of teaching, another form of recitation, a test similar to that which life daily demands of us, viz, to know some things perfectly, to relate these things to new situations, and thus quickly to solve new problems.

TOPIC D: THE METHODS EMPLOYED IN TEACHING MATHEMATICS.

In no other field under discussion can tendencies be more clearly noted than in this one of methods. Though many methods are still in use, there has been within a decade a most decided veering from mechanical rule-of-thumb methods to thought methods.

The present chaotic state of our methods in mathematics seems due to a number of causes, some of which are (1) the various views of what number is; (2) difference of opinion as to what shall be selected from the whole field to be taught in grades 1 to 6 of the elementary school; (3) the bondage we are in to past ideals; (4) the inertia of the school itself or the slowness with which a great institution like the school changes; (5) recent marked progress in the industrial world, demanding different life preparation of elementary school graduates; (6) social progress; and (7), though by no means least, the great demand for teachers, a demand so urgent that we press into service vast numbers of immature girls who, though earnest and zealous, yet lack that higher and broader professional training spoken of by Münsterberg which makes a teacher see the aims of education and know well the means available for meeting these aims.

The many methods which these causes produce may, after all, be classed into two main divisions—mechanical and thought—though it is true that most methods are a decided mixture of the two.

By mechanical methods we mean such as emphasize the symbol, the form, the expression, to the subordination, or even exclusion, of the thought, the content, the meaning. In direct opposition to this, thought methods, while not ignoring expression, lay greatest stress upon meaning.

Though the various views of what number is give a very different content to the number symbols in common use—that is, 2 may mean how many, how much, location in a series, the ratio of one magnitude to another, etc., according to the individual's view of the essentials of the number idea—yet, thought methods ever give this content first place, whereas mechanical methods center about the symbol. It is to be noted, however, that the human mind tends to make automatic, mechanical, or formal whatever it can. That symbols, then, incline to supersede meaning is due to very natural causes: (1) All must admit (*a*) that conventionalized symbols are needed to insure race progress, (*b*) that the higher the degree of conventionality the further is the symbol removed from its meaning, and, consequently, (*c*) that with this greater conventionality there is increased danger that the child may never get the meaning, that the symbols will grow to have undue importance to him so that he may, indeed, become a mere juggler with figures; and (2) if it is admitted that even any part of the science of number deals not with things but with relations of things, it must readily be seen what difficulty children have in giving symbols any real content. Therefore has the teaching of the past, in a more or less conscious effort to meet children's needs, vacillated from too abstract teaching to teaching so concrete as to hide relations, or, in other words, from no attempt to make children understand, from avoiding content and giving rules and form to be mechanically learned, to such profuse and such long continued use of objects in trying to give a content to number that thinking has been retarded.

But that, in spite of our keeping away from either extreme, there is still an inevitable tendency among pupils to become formal even in what seems real thought work was proved satisfactorily to a group of observers who gave Dr. C. W. Stone's tests to one class of pupils, and, a month later, gave the same children the thought-test problems which they had not done, at the blackboard where work could be watched and where there was a chance to question the pupils. We were convinced that many of what seemed like thought processes really went off mechanically when the cue was at hand. Additional problems were given to the children, among them, this: A man hitches up a horse to a buggy and drives three hours at the rate of six miles an hour. How much farther would he have gone if he had hitched up two horses? All but one child doubled the distance. This child thought "no farther." Questioning this one child brought out from the others that the two horses would help one another so that some more distance would be covered, but certainly not double the distance. Another problem tried with many more individuals was the following (changed, in different cases, to sheep or dog on two or on four legs): If a duck weighs three pounds when it is standing on one leg, what does it weigh when standing on two? It is the exception to receive any other answer than twice the original number of pounds.

Though this remarked tendency to cast even the thinking into habitual forms must be watched throughout the early years of school life, it yet must be agreed that life demands that we learn many processes automatically. The error of the past was that these processes were the beginning and the end of the teaching. A more thorough study of method in all fields shows us that men have ever passed through three stages in the development of any field: (1) Simple or natural art, or mere manner of doing the deed; (2) conscious attention to the method, running into science; and (3) art again, finished art this time.

Methods which are predominantly thought methods plan (1) that pupils begin with content (having first felt some sensible reason for approaching the subject); (2) that they then pass to a use of symbols, to be handled automatically when expediency demands it, employing a particular form of expression only because that form best expresses the thought held; (3) that pupils are encouraged in flexibility of expression as well as of thinking, the former, however, always being controlled by the latter; and (4) that pupils are given many opportunities to exercise choice and judgment in applying the knowledge gained to life situations.

Games, plays, and construction work are some of the means employed by many grade teachers to give content to, or else a rational motive for, many phases of number work, e. g., number combinations, United States money, and fraction study.

During the current year the writer has witnessed the teaching of some arithmetic lessons dealing with (1) finding areas, perimeters, etc.; (2) subtraction; (3) areas of triangles; (4) fractions; (5) commercial discount; (6) interest; and (7) insurance. The methods employed were mainly thought methods, for each time such an appeal was made to pupils' acquaintance with life situations as to make the plan in common use a most sensible one to the child, a plan he might even think out by himself, and never have given to him as a rule to be learned. The symbols or forms of expression grew from the children's hunting the best expression to say what they thought, and though they were plainly guided into adopting conventional modes of expression, the pressure was ever from the thought side.

Modern psychology, which emphasizes the formative as well as the revealing function of expression, enables us to select our methods of procedure as well as our mathematical curriculum with much more reason than did our predecessors in education. Though in the main content should precede form, there will ever be found situations which demand form before content, or if not before content, at least without content at the time of use. When thought methods are in the main employed in the presentation of such work the teacher is first sure that she has the content herself, then she presents the process in a way to make pupils recognize its rationality, even though they can not and perhaps should not be asked to explain; drill follows, and yet demands on thinking are made throughout; applications continue the thought work, but the wise teacher patiently waits for maturity to bring full interpretation. (Long multiplication might be cited as an illustration of such work.)

Finally, methods of teaching arithmetic, besides depending upon the subject matter chosen by makers of the curriculum, vary according to the aim of teaching mathematics held by the teacher, the school, or the community—whether the end of it all is technical skill for utility or economic purposes, whether it is formal discipline or culture, whether it is to interpret the quantitative side of life experiences, or whether it is a union of all these aims. Furthermore, the still more specific method selected for each recitation in mathematics is determined by the narrow result desired or the means at hand for realizing this end, and hence often is, or may be, (1) objective, concrete, and rationally motivated, if a new topic is to be developed; (2) abstract and mechanical, if drill or mere repetition is the object; and (3) objective again, and full of original thought work, when application is the motive.

In conclusion, then, it appears that (1) the aims of teaching mathematics, the selection of subject matter, and the methods employed are constantly acting and reacting upon one another, so that a study of all is necessary to an understanding of one; (2) that topics in arithmetic for grades one to six are being rationally motivated, and processes are being steadily rationalized to the child; and (3) that thought methods are gaining ground.

II. THE ORGANIZATION OF SCHOOLS AND THE GENERAL RELATION OF EACH KIND OF SCHOOL TO THE OTHERS.

A. EXTERNAL ORGANIZATION OF THE ELEMENTARY SCHOOL.

The present organization of the elementary school is very difficult to describe, because of the many factors that have contributed to its upbuilding and the great variation that exists. We have no central school organization in the United States; each State is supreme in educational matters. The work of the United States Bureau of Education is advisory, instructive, and inspirational. It collects and publishes statistics in regard to educational matters at home and abroad; it publishes many fine articles and documents; but its greatest power lies in the way it unifies and shapes the educational thought of the country. School legislation is in the hands of the lawmaking body of each State, and the executive authority is vested in a State department. The officers of the State department are State superintendent and State board of education. The duties of the State superintendent vary in the different States, but in general, he has charge of the certification of teachers, State institute department, collection of statistics, the making of a course of study for the rural schools, publishing of bulletins on teaching, publishing of an annual report in regard to the work of the schools, and the apportioning of school funds of the State. In the States where the office of State superintendent has been dignified by giving it large opportunities and supreme authority in carrying out school matters the position is one of great honor and the educational affairs of those States are on a high plane.

The State board of education varies in its powers and functions. In some of the States it has entire charge of the normal-school system (Michigan, Illinois, Massachusetts, and Connecticut), while in others its duties are conducting examinations and certificating teachers (California and Kansas). In the States where the board is made up of educators rather than politicians the influence is marked.

The political division of the State is the county, and the educational organization has the same unit. The county officers and the county organization vary sectionally. In the South the county is the smallest political unit, while in the North the county is divided into towns or townships, and in most States the townships are divided into school districts. The reason for this difference is historical and industrial. The southern colonies had the county unit probably because of the method of holding land. The large plantations gave a thin and scattered population, and thus a large area was necessary for a unit of government. Elementary education in the southern colonies was largely in the hands of private schools, and not until after the War of 1861 did State organization of school systems become universal. The county following the political division is generally the unit of school organization at the South. Louisiana calls the county the parish.

The county school organization is in the hands of a county superintendent or county commissioners and a county board, sometimes called board of examiners, in all of the States except those of New England. The office of county superintendent is generally an elective one,[1] and the duties vary from mere clerical work to real supervision of school organization and classroom teaching. "The county superintendent of schools shall have the general superintendence of the public schools in his county, except those in the cities which are organized under special law and those in special or independent school districts, and shall visit each public school under his supervision. He shall at such visits carefully observe the conditions of the school, the mental and moral instruction given, the methods of teaching employed by the teacher, the teacher's ability, and the progress of the pupils. He shall advise and direct the teacher in regard to the instruction, classification, government, and discipline of the school and the course of study. He shall keep a record of such visits, and by memoranda indicate his judgment of the teacher's ability to teach and govern, and the condition and progress of the school, which shall be open to inspection by any school director,"[2] etc.

The county board of education in many States together with the county superintendent has charge of the examination of teachers for county certificates.

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[1] Exceptions: Pennsylvania, township trustees elect county superintendent. New Jersey, Mississippi, Virginia, State board of education appoints county superintendent. Delaware, Florida, governor appoints county superintendent. Alabama, State superintendent appoints county superintendent. North Carolina, county board of education, clerk of supreme court, register of deeds appoint county superintendent.

[2] General school law of North Dakota, 1909.

In the South, where the county is the educational unit, the duties of the executive officers are quite different. The county organization of schools in Kentucky is quite typical, and is as follows: "Each and every county in this Commonwealth shall compose one school district * * * and shall be confided to the control of a county board of education. The county superintendent of schools, county judge, and county attorney of each county of the Commonwealth is hereby created a commission to divide their respective counties into four districts as nearly equal in area as is practicable. * * * Each educational district elects, at its regular November election, one member of the county board of education. These four members, together with the county superintendent, comprise the board of education, and have entire charge of the schools of the county."[1]

"The township organization of schools is but a merger of districts, with practically the same rights and privileges as were invested in each of the original districts. The officers are chosen at the annual town meetings by all the electors, or, as is sometimes the case, the township is the unit of school government and the schools are made uniform throughout its extent. Maine, New Hampshire, Vermont, Massachusetts, New Jersey, and Indiana have a compulsory township organization by legislative enactment. In at least 21 other States there is permissive legislation."[2]

The district is the smallest unit of organization and is found in some form or other in a large number of the States. This unit grew up in New England. The Puritan's spirit of determination to provide education for his children and the inconvenience of sending pupils a long distance to school, gave us the district schoolhouse in each settlement. The families sending their children to the school constituted the school district. Its size was a matter of convenience. When the New Englanders migrated to the West they took their school unit with them, making it more definite in organization and more suitable to the land holdings in size. The district to-day is a definite division of the township and is presided over by three officers elected by the voters of the district at an annual meeting. The annual school meeting is the most perfect democracy we have, as it elects its own officers, fixes the sum of money to be raised, and votes the number of months of excess of the school year prescribed by law. The term of school office is generally three years, and the officers have power to employ teachers, handle the funds of the district, and provide for the care of all school property.

The great industrial changes in this country, the large movement of the rural population to the cities, and the settling of large numbers of the foreign immigrants in the cities, have made the district organization in many regions unsuitable. The large number of district schools with less than ten pupils has meant great expense, poor facilities for work, and unsupervised teaching. The State superintendents are urging upon the people the reorganization of the district and the consolidation of weak districts. The township unit is probably the unit of the future. Massachusetts solved this problem as early as 1882, and the other New England States have followed her example. "The school district in all towns in the state are abolished. * * * Every town shall choose by ballot at its annual meeting a superintending school committee of three. The management of the schools and the custody and care shall devolve upon the school committee, which shall annually elect a superintendent of schools, who shall not be a member of the committee."[1] This law does not apply to towns authorized to control school matters according to special conditions as in large cities. The Maine system is quite typical of township organization derived from the district organization. "The school committee of two or more towns having under their care and custody an aggregate of not less than 20 or more than 50 schools may unite in the employment of a superintendent of schools, provided they have been so authorized by a vote of their own towns at a regular town meeting or a special town meeting organized for that purpose."[2]

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[1] General school law of Kentucky, 1908.

[2] History of education in the United States ,Dexter.

Every State has made special laws for the organization of city schools, and in many cases special charters have been given certain cities to meet unusual conditions. The city unit is usually a collection of districts. It is governed by a board of education and a superintendent. Other than this there is little uniformity of organization. The city boards of education vary in number from 3 members to 84, but a very common number is 9. The superintendent is elected by the board of education and is its executive in all matters pertaining to the workings of the school.

B. INTERNAL ORGANIZATION OF THE ELEMENTARY SCHOOL.

The term elementary school has various meanings. In the Eastern States it refers to the first nine school years or grades; in the South it usually means seven grades; and in the North and West eight grades. These grades or years are usually divided into four primary grades and four grammar grades. There are, however, other organizations, as in Tennessee, where the grades are defined by law, as follows:

The course of study in the primary school shall consist of five grades and the course of study in the secondary school shall consist of eight grades.

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[1] Laws of Maine relating to public schools, 1909.

[2] Report of public instruction. New Hampshire, 1908.

> * * * Pupils completing the first-year grades and attaining proficiency therein shall receive a certificate from the State superintendent certifying that the holder has completed the primary-school course, which shall be countersigned by the county superintendent and district directors and the teacher or teachers of the school, and shall entitle the holder to enter the sixth grade of the secondary school of any school district, or of the high school of any high-school district. The county high schools shall be graded by the board of education under the general regulation of the State superintendent and supervision of the county superintendent, beginning with the sixth grade, shall be adjusted for the admission of pupils who have completed the five grades of the primary schools.[1]

The coordination of the elementary school with the secondary school has been perfected in many States by a county or State leaving examination. This examination is given by the county board of education and all papers are rated by the county board. The examinations are the same throughout the county. A pupil receiving an elementary-school diploma of this character is allowed to enter any high school of the State without further examination. In California the law is as follows:

> The courses of study for the day elementary schools of California shall embrace eight years of instruction * * * except in city school districts having boards of education, the county or city and county board of education shall provide for the conferring of diplomas of graduation by examination upon the pupils who have satisfactorily completed the course of study provided for the day and evening schools of the country or city and country.[2]

The States that have provided for the coordination of the elementary school with the high have raised their rural schools to a higher plane. The teachers who do not succeed in preparing their last classes for these county examinations soon find that there are no schools needing their services. Many schools look forward to the elementary-school graduation with as much pleasure as to the high-school graduation.

Some of our best educators are recommending a six-year elementary school period, to be followed by a six-year secondary school. This plan has many arguments in its favor. The pupil at the close of the sixth grade should be between 12 and 13 years of age. Those that are under grade average about 14. The under-grade pupils are in general the ones who leave school as soon as the age limit of compulsory education is reached. Nearly all of the States make the age limit 14 years. It would be an incentive to good work and regular attendance for the pupil to feel that graduation and a diploma are within his reach. From 12 to 14 there is a marked change in the ability of pupils to think and to grasp the meaning of problems. The teacher who is a specialist in his line of work appeals to the pupil. This is shown in the marked success of the departmental plan for the grammar grades. Looking toward a six-year high school a number of our schools already have a seven-grade elementary school and a five-year high school. The Horace Mann School of New York City finds the latter an admirable scheme of organization.

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[1] Public school law of Tennessee, 1909.

[2] School laws of California, 1909.

C. EFFECT OF THE ABOVE UPON THE TEACHING OF ARITHMETIC.

This report is particularly interested in the effects of the organization of the schools upon the teaching of arithmetic. "There is not complete agreement among teachers as to the extent and character of the number work of the first school year."[1] All schools, rural and village, agree in general as to the amount of arithmetic to be covered in the grades, but the grade where formal arithmetic should begin, the way arithmetic should be taught to the young child, and the grade where arithmetic should be completed, are unsettled. "For the first half year the work should be mainly oral and largely incidental to other school exercises, especially to the construction work."[1]

"There should be no formal number work in this grade. In connection with the general oral lessons and occupation work many facts concerning the simpler number relations are informally presented and acquired."[2]

"Arithmetic grows out of other school exercises and is applied in problems of construction."[3]

"In grade one the children repeatedly discover numerical relations through counting. In grade two numerical relations are further revealed through work with measures. Grade three is a year of drill in number facts, the teacher resorting to the use of measures only when necessary. Grades four, five, and six are drill years in the processes and operations, with an increasing amount of applied arithmetic. In grades seven and eight pupils should increase in facility through abstract drill and in power to reason through applied arithmetic."[4]

In the course of study prepared for the rural schools of Michigan the entire work of the first four grades is oral, and the work of the first two places the emphasis on sense training. In the course of study prepared for the District of Columbia the first year is given to sense training. In the schools of San Francisco all of the work of the first grade is oral. It includes counting, addition, and subtraction, with nine as the limiting number. In the training school of the Michigan State Normal College the first year of the arithmetic course is devoted to sense training. "Not to put arithmetic as a topic in the first grade is to make sure that it will not be seriously or systematically taught in nine-tenths of the schools of the country.

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[1] Course of study for the common schools of Illinois, 1907.
[2] Course of study, Denver public schools.
[3] Course of study, Cleveland public schools.
[4] Course of study, Boston public schools.

The average teacher, not in the cities merely, but throughout the country generally, will simply touch upon it in the most perfunctory way. Whatever of scientific statistics we have show that this is true and that children so taught are not, when they enter the intermediate grades, as well prepared in arithmetic as those who have studied the subject from the first grade on.

"Furthermore, while it is true that the essential part of arithmetic can be taught in about three years, it can not for psychological reasons be as well retained if taught for only a short period. The individual needs prolonged experience with number facts to impress them thoroughly on the mind."[1]

In regard to the completion of arithmetic there are three positions taken: First, that arithmetic should continue through the eight grades; second, that arithmetic should be completed in the seventh grade and algebra or geometry given in the eighth grade; and third, the simultaneous teaching of arithmetic and algebra or geometry in the eighth grade. The majority of schools teach arithmetic through the seventh and eighth grades but introduce the use of the equation in the fifth grade and give in the seventh and eighth grades some descriptive geometry in connection with mensuration. This course seems to make the necessary preparation for high school work.

D. ELEMENTARY PRIVATE SCHOOLS.

The private elementary schools are few in number. They are generally organized in connection with the private secondary schools as the elementary department. The private schools of the country are largely located in the East and South. Their purpose determines the organization and course of study. "The school aims to offer educational facilities fully abreast of the changing conditions of modern life; to retain those features of scholastic work that experience has stamped as sound and effective; to inaugurate promptly such plans as local conditions may require."[2] "The purpose of the school is to maintain a high order of training—mental, moral, and physical—to both boys and girls of the primary, intermediate, and high school grades.[3]

"The object of the school is to give thorough preparation for colleges and universities and at the same time to give instruction in those branches of an English education necessary to success in the ordinary pursuits of life."[4]

"The formation of character and not the acquisition of knowledge as an end in itself is the chief purpose of the school—a purpose which the home and school should pursue together, in close cooperation with each other."[1]

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[1] David Eugene Smith: The teaching of arithmetic. Teachers College, Columbia University Press.

[2] Friends School, Baltimore, Md.

[3] Friends School, Washington, D. C.

[4] University School, Montgomery, Ala.

"The title 'University School' partly explains itself, for the school's first aim is to thoroughly prepare boys for college work. The second particular purpose of the school is physical and moral development in connection with mental work."[2]

"The end set up is a social, an ethical one. The means taken to attain this aim are: First, the inculcation of the democratic spirit. * * * Children of the rich and poor and of different nationalities and races are to meet together and learn to respect one another, both in their work and their play; secondly, the awakening of serious intellectual interests and enthusiasms in order to counterbalance the pleasure-loving and self-indulgent tendencies; third, the awakening of the spirit of social service by enlisting the interest of the students in the work of settlements and neighborhood houses with which the school is in touch; fourth, the building up of a largely humanitarian and ideal purpose toward which all lines converge."[3]

And thus to give the aim and organization of the private school is to write all the individual means of carrying out the various aims. In general, the organization and course of study are the same as in the public elementary school. In place of emphasis each school shows its own individuality in carrying out the purpose for which it was organized. The variation in amount of arithmetic taught and time given is quite similar to that of the public school.

III. THE MATHEMATICAL CURRICULUM IN EACH TYPE OF SCHOOL.

Information concerning the course of study for the first six years of the elementary schools was obtained from the replies to a questionnaire sent to all States and leading cities and from an examination of a large number of printed courses of study.

Of the 48 States and Territories to which questionnaires were sent, 40 were heard from either directly through the State superintendent or from a representative city within the State. The eight from whom no replies came were in all cases States of small population. Of the 25 largest cities, 24 replied; of the 50 largest, 37 replied. The total number of cities heard from was 52. The total number of questionnaires sent out was 200; the number of usable replies, 90.

The replies from the leading private schools were limited and, as far as they could be interpreted, differed but little from those of the public schools. The replies from the State superintendents were inadequate owing to the impossibility of making generalizations upon the work of a State where there is of necessity, with few exceptions, great variability in the courses of study. The most valuable replies were those from the leading cities of the country. A statistical report was therefore made from these. The 52 city school systems which formed the basis for the work represented in the aggregate 2,480,000 pupils. Every section of the country was represented, but the most densely populated States, such as New York, Pennsylvania, Ohio, and Massachusetts, were proportionately largely represented.

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[1] Francis W. Parker School, Chicago, Ill.

[2] University School, Cleveland, Ohio.

[3] Ethical Culture School, New York City.

The questionnaire was in three sections. The first section asked for the means employed to broaden the scope of arithmetic, the second for means used to narrow the field, and the third asked for specific information as to the time the study of number was commenced and the year in which different arithmetical topics were studied.

The questions as to the means employed to broaden the scope were: (1) Are geometric forms studied? (2) Are the equation and a literal notation used in the solution of problems? (3) Is the application of number to manual training emphasized? To geography and nature study? To practical affairs? (4) What other means are used to broaden the scope of arithmetic?

In reply to the question as to the means used to broaden the scope of arithmetic through the study of geometric forms 72 per cent of the school systems replied in the affirmative, 23 per cent were in a qualified affirmative, such as "somewhat," "a little," making a total affirmative of 95 per cent and a total negative of 5 per cent. The questions on the equation and literal notation were, it was evident, understood to include seventh and eighth grades instead of the grades within the limits of the investigation. The replies, although of little value for this report, were as follows: Affirmative for the use of the equation, 51 per cent; qualified affirmative, 36 per cent; negative, 13 per cent; affirmative for the use of a literal notation, 9 per cent; qualified affirmative, 50 per cent (all labeled for seventh and eighth grades); negative, 41 per cent. In reply to the question on the application of number (1) to manual training, 50 per cent of the school systems replied in the affirmative; 35 per cent with a qualified affirmative "somewhat," making a total affirmative of 85 per cent and a negative of 15 per cent; (2) to geography and nature study, affirmative, 50 per cent; qualified affirmative, 18 per cent; total affirmative, 68 per cent; negative, 32 per cent; (3) to practical affairs, affirmative, 95 per cent; negative, 5 per cent. Typical replies to the fourth question as to other means used to broaden the scope of arithmetic were: "Our tendency is to concrete work in all grades in terms of a child's experience;" "Data for exercises taken from actual measurements and actual affairs;" "Practical affairs cover the ground;" "Arithmetic throughout is considered a social study;" "Use of actual tax bills, gas bills, water bills, etc. (forms borrowed from public service companies); " "Arithmetic not valued as formerly for its worth in discipline, but it is being made very practical;" "Connected with home life and local industries."

The questions on the means used to narrow the field were: (1) Do you have the children do more work with small numbers and less with numbers in the millions than formerly? (2) Do you teach only those arithmetic topics for which children have immediate use, excluding such topics as interest and wall papering? (3) Other tendencies?

Of the replies as to the use of smaller numbers 91 per cent were affirmative, 3 per cent qualified affirmative, making a total affirmative of 94 per cent and a negative of 6 per cent. In reply to the question on the choice of those subjects for which the children had immediate use, 44 per cent replied in the affirmative, 32 per cent gave a qualified affirmative, making a total of 76 per cent affirmative and 24 per cent negative. The replies to the third question "Other tendencies" ran as follows: "Toward simplification," "Our tendency is toward the elimination of topics not clearly serviceable," "We emphasize mental and oral work with small numbers to secure facility in common processes," "Insistence upon simple problems and proficiency within narrow limits," "Toward simplification, accuracy; certainty," "Much work with small numbers; simplified problems," "The elimination of topics; emphasis on mental work."

In the third section of the questionnaire the following questions were asked: In what year is the study of arithmetic commenced? The four fundamental processes completed? The study of fractions commenced? The study of fractions emphasized? Ratio studied? Percentage commenced?

The replies answering these specific questions as to the order of work were as follows: Number was recorded as commenced in first grade in 71½ per cent of the school systems replying; in second grade in 22 per cent of the schools and in third grade in 6½ per cent. The four fundamental processes were reported as completed in the third grade in 5 per cent of the schools replying; in fourth grade in 78 per cent of the schools; and in fifth grade in 17 per cent. Fractions were commenced in the first grade in 14 per cent of the schools replying, in second grade in 21 per cent, in third grade in 17 per cent, in fourth grade in 21 per cent, and in fifth grade in 27 per cent. Fractions were emphasized in the third grade in 2 per cent of the schools replying, in fourth grade in 10 per cent of the schools, in fifth grade in 63 per cent, in sixth grade in 23 per cent, in seventh grade in 2 per cent. Ratio was studied somewhere in the lower grades as a basis for later work in 40 per cent of the schools, in the middle grades (fourth, fifth, and sixth) in 30 per cent of schools and left entirely for upper grades (seventh, eighth, and ninth) in 30 per cent of the schools. Percentage was commenced in the fourth grade in 5 per cent of the schools, in fifth grade in 30 per cent of the schools, in sixth grade in 45 per cent, and in seventh grade in 20 per cent.

It is difficult to get at the real truth in any situation through a system of questions and answers for the reason that almost any question which can be formulated admits of misinterpretation. By comparison of the replies to the questionnaire with the printed courses of study it was found that the greatest liability to misinterpretation lay in the first section of the questionnaire, which refers to the means used to broaden the scope of arithmetic. The replies throughout the section included in many cases the seventh and eighth years of the elementary school. This makes it necessary to interpret not only the answers in the equation and literal notation in a different way from which the replies indicated (attention has already been called to this), but the answers also on the application of arithmetic to manual training, geography, and nature study. In the second section of the questionnaire there was no difficulty. In the third section there was some difference in the interpretation of the question on the year in which number was commenced. In several schools where number was introduced incidentally in the first grade it was sometimes recorded as commenced there and sometimes not. The report, therefore, gives an idea of an earlier commencement of the formal study of arithmetic than actually exists. There was a similar confusion between incidental and formal work in fractions and ratio. Much incidental work in fractions is done in the first three years, but the study of a fraction as a fraction is left in the majority of cases to the fourth and fifth years. Ratio forms the basis of several special methods of teaching number used in many localities throughout the country. In such cases it is recorded as studied in the primary grades. Ratio and proportion as such are usually put down in the printed courses of study as work for the seventh and eighth years.

The summary is indicative of an advance in the work in general. One step forward is the tendency to broaden the scope of arithmetic so that it is less a series of exercises for the manipulation of figures and more of an introduction to mathematics in general. If we may take the summary as typical of the state of affairs, the study of geometric forms is becoming current, and in the seventh and eighth grades the use of the equation and of literal notation is making some headway. It is possibly wise that the latter are not used below these years, owing to the fact that the substitution of a formal means of solving a problem for a child's own natural logic is likely to cause confusion in his mind. The tendency to correlate arithmetic with other subjects and make it a thoroughly practical subject is strong. An equally striking demand throughout the country is the cry for the simplification of arithmetic through the use of smaller numbers, the elimination of topics, the simplification of problems, and an emphasis on mental rather than written work. The tendency is to limit the work to what comes within the child's experience and expect greater efficiency within the narrower field. As to the program of work there is a tendency to begin number somewhat later in the primary school than formerly; to devote the years before the fifth grade to the four fundamental processes with integers, the fifth year to fractions, and the sixth year to fractions and percentage.

Since the cities as a usual thing are in advance of the smaller communities and the rural districts and serve, more or less as their leaders, the summary is more indicative of the trend of the courses of study than of the state of things as they actually exist. It shows a more advanced state of affairs than would be found extant if an average could be made of the work of the country as an entirety.

IV. THE QUESTION OF EXAMINATIONS FROM THE POINT OF VIEW OF THE SCHOOL.

The specific purpose of this section is to treat the question of examinations from the point of view of the school in its present status and as to its present tendencies.

The main sources of data on which this report is based are: (1) the returns from the questionnaire, formulated in conjunction with the subcommittee on the nature of promotion in elementary schools and admission to secondary schools, and sent out by the United States Commissioner of Education, and (2) the subcommittee's knowledge of the uses being made of "standardized tests."

Of the 1,000 questionnaires returned, 427 were fully tabulated. These were the first received and are believed to be representative.

The subject as assigned placed the emphasis on examinations as used and viewed by immediate school workers rather than by superintendents or examining boards. Hence the superintendents were requested to have the questions answered by their principals. This was done so as to make the replies represent more fully "the point of view of the school." Answers from teachers would have represented this point of view still more fully, but the securing and handling of a sufficient number to be representative of the entire country seemed impracticable.

Conclusions based on returns from questionnaires must always be made guardedly. Caution is especially necessary in dealing with these returns because of the unavoidable vagueness and overlapping of some of the answers. However, the tabulated answers seem to warrant the following conclusions:

1. The use of examinations is very general, practically universal. They are made use of to some extent in all grades above the second; 102 of the 427 schools report their use in the second grade; twice as

many in the third; and in the fourth, fifth, and sixth grades practically all report them.

2. In this very general use of examinations the point of view of the school is commonly recognized. This is clearly shown in the answers to the question, By whom are the questions made out? Only 106 of the 427 reports show the superintendent making examination questions independently; 220 show the teachers and superintendents or supervisors in cooperation; 203 show the teacher making questions independently; only 48 principals are reported as making the questions; and in only 22 answers were there any State or county questions reported.

3. There is no agreement as to the frequency of giving examinations. One hundred and forty-two say every month or less; 124 irregularly; 55 bimonthly; 48 quarterly; 180 twice per year; and only 19 annually. One conclusion seems safe, viz., that the practice of giving "finals" at the end of the year is decidedly uncommon. However, the 180 giving them twice a year may indicate some additional use as "term end" finals.

4. The use of examinations seems to be decreasing somewhat. Two hundred and fifty-six say it is decreasing, while 110 say increasing; 97 report no change; 57 do not know; and 19 say that the nature of examinations is changing.

5. The purposes for which examinations are given are not clearly indicated. There were only 99 of the 427 that gave "aid in determining promotion or giving marks" as a purpose, while 181 gave the answer, "to help the teacher judge the efficiency of her teaching;" and 390 "to test the knowledge or power of the pupils." While the vagueness of the last answer makes it susceptible to several interpretations, taking the 390 with the 181, it is probably safe to infer that the largest single purpose of examinations is to measure progress of pupils.

6. There seems to be a clearly voiced desire for "standardized tests;" 289 of the 427 answered "Yes" to the question, "Do you believe that there is any increasing desire for standardized tests?" and 73 said that such tests would be desirable if available; only 92 answered "No" and 22 "Not desirable." Those who understand the idea of such tests are enthusiastic in their approval.

The questionnaire answers gave evidence that standardized tests are not widely known; that they are comparatively little used; but that there is a present tendency to do so, since several representative schools are making use of tests recently published in book form.[1] These tests are standardized in that, under identical circumstances, they have been used to measure the abilities of pupils in the second half of the sixth school year in representative systems of schools; and in that the respective achievements of these pupils are given in the book. By using these tests as directed anyone can determine where his pupils stand in the essentials of arithmetic as compared with the pupils of some of the best systems in the United States.

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[1] Arithmetical Abilities, by C. W. Stone, Teachers College Bureau of Publications, Columbia University.

Accounts of four of the uses of these standardized tests have recently been published. The most recent of these articles is by Mr. J. C. Brown, of the Horace Mann High School, New York City, who used the "fundamental" test as a basis for determining the value of drill.[1]

Another recent investigation in which the tests were used was made by Prof. W. S. Smiley at the State University of Iowa. Prof. Smiley measured and compared the arithmetical abilities of one room of rural school pupils and graded town school pupils.[2]

Messrs. Birckhead and Somers, principals of schools at Louisa, Va., and Red Hill, Va., respectively, used the tests to measure arithmetical abilities in six representative public schools of Virginia.[3]

The most extensive study utilizing these tests is that made by Mr. S. A. Courtis, of the Detroit Home and Day School, a private school for girls in Detroit, Mich. Mr. Courtis is using the tests as a means of determining the effects of certain changes in the teaching of the mathematics for which he is responsible. Mr. Courtis has written a number of articles on the subject; he says in conclusion:

> More than all else, it has proved conclusively to the writer at least, that it is practicable to measure not only the general condition of arithmetic teaching throughout a school, the growth in ability and efficiency from grade to grade, the defects and needs of any one grade or individual, but the effects of changes in method or procedure as well.[4]

The value of standardized tests has appealed so strongly to Mr. Courtis that he has recently published a set that are by far the best extant;[5] and mathematics teaching will doubtless receive even greater help from him in the near future.

Another use of these tests may be illustrated by tests recently given to determine the effects of changes in teaching. When tested in 1907 the pupils of a certain school made a score of 468 points per 100 pupils in reasoning, and 2,311 points per 100 pupils in fundamentals. In 1910 the pupils of this same system made a score of 607 in reasoning, a gain of 139, and a score of 2,833 in fundamentals, a gain of 522.

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[1] An investigation of the value of drill work in the fundamental operations. Journal of Educational Psychology, February, 1911.

[2] A comparative study of the results obtained in instruction in the "single teacher" rural schools and the graded town schools. Elementary School Teacher (University of Chicago Press), January, 1911.

[3] How do our Virginia schools stand in arithmetic? Virginia Journal of education (Richmond, Va.), March, 1910.

[4] Elementary School Teacher, October and December, 1909, and December, 1910.

[5] The Courtis standard tests in arithmetic with manual of instructions for giving and scoring. S. A. Courtis, 441 John R. Street, Detroit, Mich.

Thus the use of these tests indicate that in this school the present teaching of arithmetic produces considerable more ability in the essentials than did the teaching of 1907.

Another purpose for which these tests are being given is to measure the effect of such radical changes in administration as omitting all arithmetic work from grades one and two. This experiment has been tried in several cities in New England, in a few on the Pacific coast, and in one in the Middle West.

The question that immediately arises is, How well do children learn arithmetic without its being taught during the first two grades? This question is being answered by measuring the abilities of children so taught and comparing them with the achievements of children who have had arithmetic teaching during the first two grades. In one of the above-mentioned systems the last class of pupils in the second half of the sixth grade, who had had arithmetic teaching in grades one and two, were measured. During the present school year the first class of pupils who have not had arithmetic teaching in grades one and two will reach the second half of the sixth grade. The abilities of this class will be measured and the results of measuring these two sets of pupils from the same system, together with the results from the original twenty-six systems, will constitute the basis of a comparative study which may yield objective data for answering questions concerning the advisability of omitting arithmetic teaching from the first two grades.[1]

The question of examinations from the point of view of the school may be summarized as follows:

1. Examinations are used in some form in some grades in practically all schools.
2. The point of view of the school is largely recognized.
3. As to the purpose of examinations and their frequency there is no agreement.
4. Their use is probably decreasing, especially the use of "finals," as the main basis of promotions.
5. There is increasing desire for "standardized tests."
6. These tests are beginning to be used to measure the relation between the theories and products of arithmetic teaching; and as a means of securing data from which the best procedures can be determined.

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[1] Of course, the danger of fallacy here is evident. The abolition of arithmetic in grades one and two may have been accompanied by more enthusiastic and skillful teaching after the second grade, or by even a greater amount of time being devoted to the subject, so the results of such a comparison must be guarded by checks.

V. THE METHODS EMPLOYED IN TEACHING ELEMENTARY MATHEMATICS.[1]

I. SCOPE OF THE STUDY.

It is the function of this study to convey some notion of the methods employed in teaching mathematics in the first six grades of the American elementary school. No attempt is made to give a minute description of the endless details of teaching procedure, nor even to enumerate all the types of teaching method employed. Its purpose is restricted to an analysis of the larger tendencies in teaching practice which are representative of the spirit of mathematical instruction in the lower schools.

Owing to the existing confusions, it is well at the very outset to have in mind a clear definition of the term "teaching methods." Teaching methods are always methods of presentation. In this respect the teaching art is like any other art, literary, graphic, plastic, or what not. The literary artist, for example, has a purpose, a subject matter, a particular audience, and a special style of presentation. All these factors are present in the teaching art. The aims of instruction, the particular facts to be taught, the immaturity of the child taught, and the inevitable personality of the teacher determine the style of instruction, or, to use our own "trade word," a method of teaching. Every teacher, then, has a style or method—conscious or unconscious, good, bad, or indifferent. Unlike the literary artist, he has many ends to serve rather than one. His functions are general to life, and include moral, social, and personal ends, as well as those that are æsthetic. His methods of communication, too, are more than one. He presents his experiences objectively and graphically, as well as through the medium of written words and speech. Always the teacher's end is to stimulate growth through the presentation of experiences. When that presentation of experience takes a form and order different from that usual to adult life for the precise purpose of making the fact more readily comprehensible by the immature mind of the child, then that modification may be called a method of teaching. Teaching methods are always special manners of readjusting adult wisdom to the special psychological conditions of a student's mind.

In the concrete, methods of teaching would always represent something particular to a situation, and as variable as situations are variable. Life is never just the same at any point. Yet certain essential similarities exist and give us the opportunity to interpret life in terms of law. The same may be said of the teaching life. In a sense it never repeats itself, yet to the degree that the same end, the same subject matter, and the same immaturity of mind recur in classrooms, teachers will tend to use similar modes of adjustment. In describing mathematical teaching in the primary schools, it is these similar modes of teaching adjustment, these similar "general methods" that we shall describe and analyze.

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[1] This part of the report was prepared by Prof. Henry Suzzallo, Teachers College, Columbia University, New York City. In more extended form it appeared in the Teachers College Record for March, 1911.

It will be unnecessary to have a separate treatment of the "general methods" of mathematical teaching for public schools and private schools. Whatever may be said of the State-supported schools will in general be true of private institutions. It is true of elementary schools, as it is not of secondary and higher schools, that private institutions hold a relatively minor place, as compared with public or State schools. They are in a sense mere adjuncts to the public-school system, claiming, in the generality of cases, no real difference in their ideals and methods of instruction.

It will perhaps simplify the task of this study and make its treatment more thoroughly representative of all conditions, if the general methods described be restricted to that field which is most characteristic of the first five or six years of mathematical instruction, namely, to the teaching of the fundamental processes of manipulating integers and fractions along with their simple applications to concrete problems.

While the aspects of mathematical instruction here studied and presented are selected because of their representative nature, it would be unwise to restrict ourselves to a statement of the commonly accepted procedures of schoolroom practice. There are in America certain reform tendencies which are as characteristic of conditions as are the conservative practices. These modifying forces need to be mentioned along with the practices that they alter. Again, there are certain scientific efforts, now well underway, to study the problem of methods in teaching. While these have, as their immediate aim, the acquisition of new knowledge rather than direct educational reform, their ultimate effect will be to change methods of teaching. For this reason they are important, and have a proper place in this presentation.

II. THE INFLUENCE OF AIMS ON TEACHING.

The purposes of mathematical instruction in the elementary school must always be very influential upon method. It makes a great difference whether one is merely teaching the elements of mathematics or is teaching mathematics as a tool for business life.

THE INFLUENCE OF A SCIENTIFIC AIM.

It has not been long since the aim of mathematical teaching was merely scientific. The facts taught were the beginning of a science, and the end was to obtain a foundation for more advanced facts of the same kind which were dependent upon this foundation. As the teacher had learned his mathematics, so he taught the subject. To a considerable degree as the master's adult mind classified the facts of the subject, so he presented it to the child. His methods were logical rather than psychological. He gave the finished product or process to the child without special modification because the child was immature; a roundabout method that slowly approximated and only finally achieved the full result was with such a teacher exceptional.

Such a scientific aim, implicit rather than expressed, dominated the methods of teaching when arithmetic was handed over to the elementary schools by the higher institutions of education. As the first purpose to be rooted in the traditions of mathematical teaching it still persists with all the rigidity of a conservative force. Teachers still tend to teach future workmen in the lower schools as they themselves were taught by scientific scholars in the universities. And high school and college instructors still impose their standards upon the lower schools so as to influence their methods of instruction. As the purposes of higher instruction still remain largely scientific in purpose and method they give aid to the persistence of an original tradition in the elementary schools. Under such an influence the worth of a mathematical fact is measured by its place in a logical scheme, rather than by its significance and recurrence in everyday life. The mathematician may need to know all about the names of the places in notation and numeration; the layman cares only about the accurate reading and writing of numbers, and not at all about the verbal title of "units of thousands" place. Again, the rational needs of a thinker about mathematics may require an understanding of the reasons why we "carry" in column addition, but the effective everyday use demands an accurate habit of "carrying" rather than an accurate explanation. Yet just such methods persist in our schools because of the domination of a scientific treatment of the subject.

The remoteness of such mathematical teaching from the needs of common life constantly threatens the loyalty and support of the public. Some defense becomes necessary on other than scientific grounds. Such a sanction could not be found in utilitarianism, for the waste was evident. It remained for a psychological theory to sketch a defense upon "disciplinary" grounds. The doctrine of "formal discipline" says that such mathematical teaching trains the powers of the mind so that any mastery gained in mathematics is a mastery operating in full elsewhere, regardless of the remoteness of the new situations from those in connection with which the power or ability was originally acquired.

The effect of such doctrine is to defend and perpetuate every obsolete, unimportant, and wasteful practice in the teaching of mathematics. No matter that partnership as taught in the schools had its original sanction in its close correspondence to the reality of business practice; no matter that the old sanction had passed; teach it now for its ability to discipline the mind. This questionable psychological doctrine, said in consequence, "Whatever is, is right!" No matter that "life insurance" touches more men than "cube root"; the latter should be kept because of its power to train the mind. In life, where "approximation" of amounts suffices, the teacher demands absolute accuracy, and the ethical worth of such precise truth is the high law for its defense. Regardless of the truth that is concealed in the doctrine of "formal discipline," it must be confessed by those who know the history of teaching methods in the United States that it is the main defense of conservatism and the largest cause of waste in teaching methods.

Such has been the ground upon which recent educational reform has operated. Slowly the older scientific and disciplinary aims of instruction have given way to the newer purposes of business utility and social insight. In that step a large transition was covered. Before the school had measured the worth of its work by standards internal to educational institutions, the schoolmaster and the scholar, rather than the man on the street, had formulated the scientific classifications of mathematics and expounded the doctrine of formal discipline. Hereafter the measure of efficient school instruction is a reference to standards external to the school, the product of conditions outside of school life. Business need and social situation determine if a fact or process is worth comprehending, and whether the method of instruction has been effective.

Business utility, coming at a time when the elementary-school course was felt to be overcrowded, met with a ready reception. It operated for the time being as the standard by which materials and methods in arithmetic are to be eliminated, if not actually selected. Materials not general to the business world, such as the table of troy weight, were therefore eliminated. Processes of computing interest infrequently used were supplemented by more widespread and up-to-date methods. More doing and less explaining characterized the instruction in adding columns of figures, and such manipulation mimicked the exact conditions of its use in the world at large. If strings of figures are usually added in vertical columns in the business world, then they should be taught in vertical columns more nearly exclusively than before. The obsolete and the relatively infrequent, the over-complex and the wasteful processes of the old arithmetic tended to disappear. More than any other influence this aim of business utility has combated the overconservative influence of scientific and disciplinary aims which dominated previous decades. The newer methods of teaching have kept the best of the old movements. The work is still scientific in that it is accurate; it is still disciplinary in that it trains; but the truth and the training which are given are selected by and associated with actual business situations common to everyday life.

There is evidence in the present thought of teachers that a broader utility than that of the business world is beginning to obtain in the schools. The general increase in the social consciousness of the teacher is reflected in mathematical instruction. Everywhere in these days the American teacher and the educational writer speak of the social aims of education. The influence of the social aim of instruction upon mathematical instruction is subtle but obvious. The business man's opinion with reference to arithmetical instruction is not always taken as gospel. There are other standards. "Why," says the schoolmaster, "should I train people for your special needs, any more than for the demands of other trades that men ply? To be sure, our graduates do not fit perfectly into your shop at once. But that precise and local adjustment is the work of the business course or of shop apprenticeship. My function is to train men for the situation common to all men and special to no class. The elementary school is a school for general culture or social appreciation, not a business college or a trade school." The sociologist usurps the place of the business man as the school's proper critic.

The situation to-day as influenced by existing aims is one of transition in which old and new purposes mingle with unequal force in giving us a mixed process of instructing American youth in arithmetic. Old materials and methods still persist, for logical and disciplinary ideals still hold; but the newer regimen ushered in by the demands of business utility and social understanding gains ground. The obsolete, the untrue, the wasteful methods pass from arithmetic teaching, and the pressing, modern, and useful activities and understandings enter. Arithmetic is less abstract and formal as a subject than it was; it has become increasingly vital and concrete with real interests, insights, and situations. The grind of sheer mechanical drill decreases in its teaching, and a reasoned understanding of relations, in some degree, at least, is substituted. Artificial motives and incentives are less frequently used to get work done, and the appeal of live institutions for a quantitative solution and understanding increasingly asserts itself.

III. THE EFFECT OF THE CHANGING STATUS OF TEACHING METHOD.

Teaching method in the school is primarily a readjustment of forms of knowledge and experience so as more effectively to stimulate and improve the immature responses of children. Two important movements have been responsible for the development of special methods of teaching during the past few decades—one is humanitarian and the other scientific. On the one hand, there has been a growth in reverence and sympathy for childhood. As yet it has scarcely expressed itself with fullness. The wide acceptance of the "doctrine of interest" in teaching; the enrichment of the curriculum; specialized schools for truants and defectives; individual instruction—these are the schoolmaster's recognition of the modern attitude toward childhood. Under such conditions teaching becomes less and less a ruthless external imposition of adult views, and more a means of sympathetic ministry to those inner needs of child life which make for desirable qualities of character. While it is true that teaching method is a condescension to childhood, it is a socially profitable condescension in that it is a guarantee of more effective and enduring mastery of the life that is revealed at school. Since the child's acquisition tends the more to be part and parcel of his own life under such sympathetic teaching, the products of such instruction are enduring.

Such a humanitarian movement naturally called for knowledge of the child. The wisdom of common sense soon exhausts itself and more scientific data is demanded. Thus the "child study movement" came into existence. Since then, a saner psychological foundation has been laid for educational procedure, one which is criticising and reconstructing teaching method at every turn. Hitherto teaching methods had been improved fitfully through a crude empiricism. Now a body of general psychological knowledge, rich in its criticism of old methods and in its suggestion of new means of procedure, gives a scientific basis to teaching method.

The public elementary school teacher is conservative indeed who will deny that there is anything worthy in the notion of "method!" As a class, teachers have faith in the special professional technique which is included under the term. They are critical of the many abuses which have been committed in the name of method. Method can not be a substitute for scholarship. It can not be a "cut-and-dried" procedure indiscriminately or uniformly applied to classroom instruction. Like every other technical means, teaching method is subject to its own limitations and strengthens a fad which the average teacher recognizes.

In spite of the fact that the majority of elementary teachers keep reasonably sane on the problem of method in teaching, it must be admitted that a considerable proportion of teachers are inclined to be attracted by systems of method that greatly overemphasize a single element of procedure. The hold which the "Grube method" with its unnatural logical thoroughness and progression gained in this country two or three decades ago is scarcely explicable to-day.

Scarcely less baffling is the very large appeal made by a series of textbooks which laid the stress upon the acquisition of arithmetic through the idea of ratio and by means of measuring. Manual work as the source of arithmetical experiences is another special emphasis, which, like the others, has had its enthusiastic adherents. Again, it is "arithmetic without a pencil" or some other overextension of a legitimate local method into a "panacea" or "cure-all" which confronts us. The promulgation and acceptance of such unversatile and one-sided systems of teaching method are indicative of two defects in the professional equipment of teachers: (1) The lack of a clear, scientific notion as to the nature and function of teaching method, and (2) a lack of psychological insight into the varied nature of classroom situations. Untrained teachers we still have among us, and others, too, to whom a little knowledge is a dangerous thing. These are frequently carried away by the enthusiastic appeals of the reformer with a system far too simple to meet the complex needs of human nature. Our experiences seem to have sobered us somewhat, the increase of supervision has made responsible officers cautious, and increased professional intelligence has put a wholesome damper upon naïve and futile proposals to make teaching easy.

A more serious evil than that just mentioned is the tendency of the supervising staff to overprescribe specific methods for classroom teachers. Recently there has developed, more particularly in large city systems, a tendency to demand a uniform mode of teaching the same school subject throughout the city. This has been brought about by the prevalent tendencies of large school systems to centralize their authority and demand uniformity of procedure. The prime causes of this tendency are to be found (1) in the specialization of grade teaching, and the interdependence of one teacher on another; (2) in the mobility of the school population which involves considerable lost energy if teachers do not operate along similar lines.

The result of such imposed uniformity is a reduction of spontaneity in teaching. The process of instruction proceeds in a more or less mechanical fashion, the teacher working for bulk results by a persistent and general application of the methods laid down. That teaching, which at every moment tends to adjust itself skillfully to the changes of human doubt and interest, difficulty and success, discouragement and insight, now taking care of a whole group at once, now aiding an individual straggler, now resolutely following a prescribed lead, now pursuing a line of least resistance previously unsuspected, can not thrive under such conditions. It stifles teaching as a fine art and makes of it a mechanical business. Under these conditions only those activities which fit the machine routine can go on. Thus it happens that we memorize, cram, drill, and review, and soon the subtler processes of thinking and evaluating, which are the best fruit of education, cease to exist.

Fortunately the one-method system of teaching will soon belong to the past, and the imposition of uniform methods is beginning to lose ground even in our cities. For the most part, the common sense of teachers and the positive statements of our better theorists keep teaching methods in a position of useful status. Teaching methods should be infinitely variable as the conditions calling for their use are endlessly changeable. Not one method but many are necessary, for their function is supplementary rather than computive. No one method should be used with a preestablished rigidity; each must be flexible in its uses, so as to accomplish the varied work to be done. The teacher directly facing the intellectual and emotional crises of childhood is the best interpreter of conditions and the best chooser of the tools of workmanship. The supervisor may advise and may point out certain fundamental laws of growth and procedure; but the concrete method which is the application of these must be of the teacher's making.

Arithmetical teaching, like the instruction in other subjects, has suffered from these widespread ventures of teaching method. In this respect it has shared the common professional lot. But in addition it has had special difficulties and adventures of its own. We have now to note those special phases of teaching method which are peculiar and local to mathematical instruction.

IV. METHOD AS AFFECTED BY THE DISTRIBUTION AND ARRANGEMENT OF ARITHMETICAL WORK.

THE TENDENCY TOWARD SHORTENING THE TIME DISTRIBUTION.

Several decades ago arithmetic, as a formal subject, was begun in the first school year and continued throughout the grades to the last school year. This is no longer a characteristic condition, much less a uniform one. There have been forces operating to complete the subject of arithmetic prior to the eighth year, and to delay its first systematic presentation in the primary grades for a period varying from six months to two years.

The attempt to shorten the period of formal instruction in arithmetic has had its effects upon the methods of teaching as well as upon the arrangement of the course of study. The presence of a large number of children who leave school by the seventh year, the example of a varied European practice, the overcrowded curriculum—all these have combined to suggest a shortened treatment of arithmetic. Hence economy, through the elimination of obsolete and unimportant topics in the course of study and through better methods of instruction, has become a pressing matter. Its influence on method is obvious.

It has focused attention upon "teaching method" and given it an increasing importance in the eyes of mathematical teachers. Specifically, it has tended to reduce the amount of objective work, to eliminate the explanation or rationalization of processes which in life are done automatically; it has made teachers satisfied with teaching one manner of solution where before two or three were given; it has laid the emphasis upon utilizing old knowledge in new places, rather than on acquiring new means.

The by-product of this belief is that any arithmetic taught during these first few years should be taught "incidentally," as a chance accompaniment of their other studies. Only after one or two years of incidental work should the formal arithmetic instruction be given. This "incidental" method of teaching beginners is difficult to estimate. It has been so variously treated that a comparative measure of its worth is difficult to obtain. The contention that children who are taught incidentally for two years and systematically for two years more have at the end of four years of school life as good a command of arithmetic as those who have had a systematic course through four school years is difficult to substantiate or deny on scientific grounds. Sometimes "incidental" teaching required by the course of study becomes "systematic" in the hands of the teacher. Sometimes the two years of "systematic" teaching that follows the incidental teaching means more than two years, since the teachers, in order to catch up, give more time and emphasis to the subjects than the relative time allotment of any general schedule would seem to warrant. Such have been the facts frequently revealed by a classroom inspection that penetrates beyond the course of study, the time schedule, and the regulations of the school board.

In the lack of specific comparative measures of the worth of such methods of instruction, there is a growing conviction (1) that beginning school children are mature enough for the systematic study of all the arithmetic that the modern course of study would assign to these grades; (2) that considering the quantity and quality of their experiences they can think or reason quite as well as memorize; and (3) that what the school requires of the child can be better done in a responsible, systematic manner than by any haphazard system of incidental instruction.

These reactionary attitudes by no means imply a return to systematic teaching of arithmetic in the first two school years, nor to such formal methods as had previously been employed. Other grounds forbid. The crude, uninteresting memoriter methods of the past have gone for good. Objective work, plays, games, manual activities make arithmetical study easier and more efficient. Indeed, these newer methods have been a large factor in convincing teachers that children have the ability to master the first steps in arithmetic during the first two years.

There are other problems of method that are not so much concerned with the beginning of the study of arithmetic, or with the span of school life that the subject is supposed to cover. These deal with the arrangement of subtopics, within the course of study, or with the manner of progression from one aspect of arithmetical experience to another.

The methods that have been employed in the United States for the arrangement or ordering of topics within the course of study have varied considerably from time to time, but all these variations may be grouped around two types: (1) The "logical" types of arrangement and (2) the "psychological" types of arrangement. If the course of study proceeds primarily by units that are characteristic of the mathematics of a mature adult mind, the type may be said to be "logical." If the course of study proceeds primarily by units that are characteristic of the manner in which an immature child's mind approaches the subject, then the type may be said to be "psychological."

The older "logical" plans are thorough and definite in their demands; the teacher always knows just what he is about. But such a system of procedure is unnatural and remote from the child; it lacks appeal and motive. The child pursues the subject as a task laid down for him, not as an answer to his own curiosities or necessities. The newer psychological plans meet the different levels of child maturity effectively; they are nearer the natural order of acquiring knowledge. But it is not easy for the teachers to keep account of the work of their own, previous, or subsequent grades. Nor does the supervising official find it easy to locate responsibility for definite arithmetical subtopics. As an order of teaching it is psychologically natural but administratively ineffective.

The result is that to-day the two types of arrangement are modifying each other and giving a mixed method, partly logical and partly psychological. That line of least resistance in which the children study arithmetical facts and processes with greatest success is modified by definite demands that topics, e. g., addition, be mastered thoroughly "then and there." The method is partly "topical" and partly "spiral." The child in the second grade may have a little of all the fundamental processes, a few simple fractions, and United States money, but just there he will be held definitely responsible for a very considerable number of the addition combinations. The pupil may have had fractions in every grade, but the fifth grade will be responsible for a thorough and systematic mastery of the same. Such is the mixed method of arrangement which is to-day prevalent in American schools.

V. OBJECTIVE TEACHING.

The use of objects in teaching arithmetic is current in the elementary school. Particularly is this true in the lowest grades of the school, in primary work. It may be said that there is a very large quantity of objective teaching in the first year of school and that it decreases more or less gradually as the higher grades are approached. By the time the highest grammar grades are reached the use of objects has reached its minimum, the underlying assumption being that the use of objects has a teaching value that decreases as the maturity of the pupils increases. Current practice does not proceed far beyond the application of the simple and somewhat crude psychological statement that the youngest children must have much objective teaching, the older less, the oldest least of all.

Reform in the direction of a more refined and exact use of object teaching has already suggested itself in the treatment of fractions and mensuration, where, regardless of the increased maturity of the children studying these topics, a large amount of objective method is utilized. This is a considerable departure from the slight objective treatment of other arithmetical topics taught in the same grades. Such exceptional practices suggest that the novelty of an arithmetical topic is the condition calling for objective work in instruction. It is immaturity in a special subject or situation which determines the amount of basal objective work. The correlation is not with the age of the pupil but with his experience with the special problem or subject in hand. It is, of course, true that the less experienced the student is the greater the likelihood that any subject presented will be novel and strange. Only in this indirect manner does the novelty of subject matter coincide with mere youth as an essential principle in determining the need of objective presentation. The naïve assumption of the older enthusiastic reformers that objective work is a good thing psychologically, one of which the pupil can not have too much, is by no means the accepted view of the new reformer. With the latter, objective presentation is an excellent method at a given stage of immaturity in the special topic involved, but it may be uneconomical, even an obstacle to efficiency, if pushed beyond.

There is then a certain coincidence of the scientific criticism of the psychologist and of the common-sense criticism of the conservative teachers who look suspiciously upon a highly extended object teaching. The teachers, on grounds of experience, say that too much objective teaching is confusing and delays teaching. The psychological critics say it is unnecessary and wasteful. The result is that, in these later days, the distribution of objective work has changed somewhat. More subjects are developed in the higher grades through objective instruction than before. Perhaps no fewer subjects in the lower grades are presented objectively, but the extent of objective treatment of each of these has undergone considerable curtailment.

The existing defects in objective teaching are not restricted to a false placing or distribution. The quality of teaching with the aid of objects is likewise open to serious criticism. Object teaching is a device, so successful as against prior nonobjective teaching that it has come to be a standard of instruction as well as a means. As long as objects—any convenient objects—are used, the teaching is regarded as good. Given such a sanction, the inevitable result is an indiscriminating use of objects. The process of objectifying tends not to be regulated by the needs of the child's thinking life; it is determined by the enthusiasm of the teacher and materials convenient for school use.

The first fact which asserts itself in observing objective teaching is the artificiality of the materials employed. Primary children count, add, etc., with things they will never be concerned with in life. Lentils, sticks, tablets and the like are the stock objective stuff of the schools, and to a considerable degree this will always be the case. Cheap and convenient material suitable for individual manipulation on the top of a school desk is not plentiful. But instances where better and more normal material has been used are frequent enough in the better schools to warrant the belief that more could be done in this direction in the average classroom. The "playing at store", the use of actual applications of the tables of weight and measures are cases that might be cited.

The materials used are not only more artificial than they need be, but they are too restricted in range. More forms of even the artificial material should be used, thus minimizing the danger of monotony.

Even the narrow range of materials in general use might be better employed than it is. There is, of course, a distinct tendency to vary the objects, merely because a child gets tired of it as a material. It is too frequently the case that the teacher will treat the fundamental addition combinations with one set of objects, e. g., lentils. In all the child's objective experience within that field there are two persistent associations—" lentils " and " the relation of addition." The accidental element has been emphasized as frequently as the essential one, and being concrete has had even a better chance to impress itself.

The nature of the materials proper to objective teaching has likewise been too narrowly interpreted. Objective teaching has meant almost exclusively instructing or developing through three-dimensional representation, whereas another form has been neglected, which for all the psychological purposes of education has as much worth as so-called objects, namely, use of such material as pictures. Such quasi-objective material has been little used by teachers save as it appears in textbooks. There are, of course, obvious disadvantages to pictures and diagrams. The things represented in and by them are not capable of personal manipulation by the child in the ordinary sense. But they have a superiority all their own. They offer a wider, more natural, and more interesting range of concrete experiences.

There are other curious phases of narrowness in the current pedagogical interpretation as to what constitutes a concrete or objective experience. It will be noted that visual objects are the ones generally employed and that they are generally inanimate objects. Of late there has been some tendency to use hearing and touch in giving a concrete basis to teaching. Advantage is taken of the social plays of children and their games with things. Here the children themselves and their relations and acts are the experiences from which the numerical units are obtained. With some of the best teachers in the lowest grades it is no longer unusual to see children moving about in all sorts of play designed to add reality to and increase interest in number facts.

Inductive teaching has been one of several movements affecting objective teaching. The effort of teachers to escape the slavishness of mere memoriter methods and to approximate real thinking led to the introduction of inductive teaching. Necessarily objective teaching became more or less identified with the new movement and was influenced by it. So, it has been said of objective work in arithmetic, as it has been said of laboratory work in the sciences, that such instruction is a method of "discovery" or "rediscovery." Such an alliance has had its beneficial effects upon objective teaching; it has redeemed it from the aimless "observational work" of an earlier "objective study." But in the teaching of arithmetic, at any rate, it confused an objective mode of presentation with a scientific method of learning truth, two activities having a common logical basis, but not at all the same. Under the assumption that the developmental method is one of rediscovery, the tendency is to give the child as complete a range of concrete evidences as would be necessary on the part of the scientist in substantiating a new fact. The result is, that long after the child is convinced of the truth, say that 4 and 2 are 6, the teacher persists in giving further objective illustrations of the fact. The child loses interest in the somewhat monotonous continuance of objective manipulations, and the teacher has naturally wasted time and energy.

Another modern movement in teaching method which has had a conspicuous effect on objective teaching is the movement toward "self-activity" on the part of the child. The recent favor enjoyed by manual training, nature study, self-government, and other active phases of school life is an index of the general movement in mind.

Its influence has not only forced the introduction of new subjects; it has changed the manner of presenting the older subjects of the elementary curriculum. Arithmetic has responded along with the other subjects and an active use of objects by the children themselves is found in increased degree.

VI. THE USE OF METHODS OF RATIONALIZATION.

It is perfectly natural that, in shifting the teacher's attention from her own activities to those of the children, the interest of the child should be considered in increasing degree. If the child is to learn directly, with a maximum use of his initiative, it is absolutely essential that the teacher should provide some motive. This implies that the child is to be interested in some fundamental way in the activities in which he is to engage. Instead of thumbing the fundamental facts with his memory, in an artificial and effortful manner, "singsonging" the tables rhythmically, so as to make dull business less dull, the teacher begins at once to use the child's own life as the basis for instruction. The number story, the arithmetical game, playing at adult activities, constructive work, measuring, and other vital interests of the child and community life become increasingly the basis of instruction in number. Such is the pronounced tendency wherever the movement is away from the traditional rote-learning or drill.

Of course there is the slight tendency in American elementary schools where a soft and false interpretation of the doctrine of interest is gospel to teach only those things which can be taught in an interesting fashion. But this tendency is less operative in arithmetic than in other subjects. Here the logical interdependence of one arithmetical skill on another has quickly pointed the failure of such a haphazard mode of instruction.

There is, however, in "advanced", as well as in reactionary quarters, a revolt against the tendency to objectify, explain, or rationalize everything taught in arithmetic. On the whole it is a discriminating movement, for this opposition to "rationalization" in arithmetical teaching, and in favor of "memorization" or "habituation," bases its plea on rational grounds, mainly derived from the facts of modern psychology.

It is specifically opposed to explaining why "carrying" in addition, and "borrowing" in subtraction are right modes of procedure. These acts are to be taught as memory or habit, inasmuch as they are to be performed by that method forever after. To develop such processes rationally or to demand a reason for the procedure once it is acquired, is merely to stir up unnecesary trouble, trouble unprompted by any demands of actual efficiency.

A study of the actual arithmetical facts upon which this opposition expresses itself suggests the four following general principles as to the use of "rationalization" and "habituation" as methods of mastery: (1) Any fact or process which always recurs in the same identical manner, and occurs with sufficient frequency to be remembered, ought not to be "rationalized" for the pupil, but "habituated." The correct placing of partial products in the multiplication of two numbers of two or more figures is a specific case. (2) If a process does recur in the same manner, but is so little used in after life that any formal method of solution would be forgotten, then the teacher should "rationalize" it. The process of finding the square root of a number illustrates this series of facts. (3) If the process always does occur in the same manner, but with the frequency of its recurrence in doubt, the teacher should both "habituate" and "rationalize." The division of a fraction by a fraction is frequently taught both "mechanically" and "by thinking it out." (4) When a process or relation is likely to be expressed in a variable form, then the child must be taught to think through the relations involved, and should not be permitted to treat it mechanically through a mere act of habit or memory. All applied examples are to be dealt with in this manner, for such problems are of many types, and no two of the same type are ever quite alike. These laws will, of course, not be interpreted to mean that no reason is to be given a child in a process like "carrying" in addition. The reason is not essential to efficient mastery, but it may be given to add interest or to satisfy the specially curious.

VII. SPECIAL METHODS FOR OBTAINING ACCURACY, INDEPENDENCE, AND SPEED.

It is not alone the first stages in the acquisition of an arithmetical process which have received attention in the reorganization of teaching methods, though, to be sure, the problem of first presentations has in recent decades been given the most attention. More and more the American tendency is to watch every step in the learning process, to provide for all necessary transitions, and to safeguard against avoidable confusions. It might be suggested that constant intermediation of the teacher in the child's work at every step might destroy the pupil's initiative and independence. Apparently, however, those who are so deeply interested that the child should not be permitted to fall into the errors which unsupervised drill would convert into habit, are fully as cautious to provide steps for forcing the child to assume an increasing responsibility for his own work. The distinction made is that an over-early independence is as fatal to accurate and rapid mathematical work as an over-delayed dependence.

One of the specific controversies much argued in the primary school concerns the medium through which arithmetical examples and problems shall be transmitted to young children. There are three typical ways in which a situation demanding arithmetical solution may be brought to the child's mind: (1) The situation when visible may be presented through itself; that is, objectively; (2) the situation may be described through the medium of spoken language, the teacher usually giving the dictation; (3) the situation may be conveyed through written language, as when the child reads from blackboard or text. Inasmuch as objects are a universal language, no difficulty arises through this basic method of presentation. It is when a language description of a situation is substituted for the situation itself that difficulty arises. The child might be able to solve the problem if he really understood the situation the language was meant to convey. Owing to the difficulty that primary children have in getting the thought out of language, it has been urged that problems in any unfamiliar field should be presented in the following order: (1) Objectively or graphically; (2) when the fundamental idea is grasped, through spoken language; and (3) after the type of situation is fairly familiar, through written or printed language. It is seriously urged by some teachers that no written presentation should be used in the first four grades. Such an extreme tendency would practically abolish the use of primary textbooks. There are many exceptional teachers who do not put a primary text in the hands of children at all. Such a tendency is increasing. Particularly is this true among primary teachers in the schools of the foreign quarters of large cities. Accurate communication through the English language is always more difficult here. Hence, the period of objective teaching is necessarily prolonged, dependence on the "number stories" told by the teacher increased, and the solution of written problems much longer delayed than elsewhere.

The situation is somewhat different, almost the opposite in fact, when "examples" rather than "problems" are presented, meaning by "example" a "problem" expressed through the use of mathematical signs. It is easier to present "examples" in written form on blackboard or in text than it is to dictate them orally. This obviates the necessity of holding the examples in mind during solution. The permanence of the visual presentation saves the restatement frequently necessary in oral presentation. Hence it is a common practice to supply the youngest children with mimeographed or written sheets of "examples." It is with older children or with younger children at a latter stage in the mastery of a typical difficulty, that oral presentation of examples is stressed. Then we have that type of work which is called "mental" or "silent" arithmetic.

There is some tendency toward the provision of better transitions from the objective presentation of applied problems to the symbolic presentation of abstract examples. The nature of such a transition is scarcely reasoned out as so much psychological science, but is the accompaniment of a widening professional movement for the enlarged use of pictures, diagrams, number stories, and the like. A critical examination of the various means of presenting arithmetical situations would order them as follows in making the transition from objective concreteness to symbolic abstractions: (1) Objects, (2) pictures, (3) graphs, (4) the concrete imagery of words, (3) more abstract verbal presentations, (6) presentations through mathematical symbols. No such minuteness of adjustment is apparent in existing methods, though it might seem desirable in teaching young children. There are four typical ways in which the child does his work, the names of which are derived from the differentiating element: (1) The "silent" method, otherwise spoken of as "mental arithmetic," "arithmetic without a pencil," etc. (2) The "oral" method, where the child works aloud—that is, expresses his procedure step by step in speech. (3) The "written" method, where the child writes out in full his analysis and calculations. (4) The "mixed" method, where the child uses all three of the previously mentioned methods, in alternation, as necessary for ease and efficiency.

The worth of these four methods of work is necessarily variable. The rapidity of the "silent method" with simple figures is obvious. The "silent method" and the "mixed method" (which is more slow but more manageable with complex processes and calculations) are the two methods normally employed in social and business life. The purely "oral" and "written" methods, with their tendency toward analysis and calculation fully expressed in oral or written language, are highly artificial. They are valuable as school devices for revealing the action of the child's mind to the teacher so that the same may be corrected, guided, and generally controlled. The present tendency is toward an over-use of these methods and toward an under-use of the other two, more particularly the "mixed" method. It would seem that there is little conscious attempt to make certain that the child moves from full oral or written statements to the judicious application of the more natural "silent" and "mixed" methods. It may be that full oral and written statements of work have seriously hampered the right use of the more natural methods of statement.

It is well to recall that in all these efforts to control the child's activity there is a tendency to leave the child overdependent upon the teacher. It is vitally important that a child should be kept free of any error which unsupervised drill would fix into the stubbornness of habit, but it is likewise important that the child should acquire some self-reliance. While not always clearly defined, there is a distinct tendency in the direction of releasing the teacher's control of the child. A characteristic practice would be one in which the teacher's work with the child would pass through various stages, each one of which would mark a decrease in the control of the process by the teacher and an increase in the freedom of the child to do his example, or problem, by himself.

One characteristic series of stages quite frequently used in the presentation of a single topic in arithmetic, say "carrying" in addition, is the following: (1) The teacher performs the process on the blackboard in the presence of the class, the children not being allowed to attempt the process by themselves until after the process is clearly understood from the teacher's development. (2) The children are then allowed to perform the process upon the blackboard, where it is exceedingly easy for the teacher to keep the work of every child under her eye. An error is caught by a quick glance at the board and immediately corrected before the child can reiterate a false impression. (3) More of the same type of example, or problem, are assigned to the children at their seats, where they work upon paper, still under the supervision of the teacher; a supervision which is less adequate, however. (4) The same difficulty, after the careful safeguarding of the previous stages, is then assigned for "home work," where the child relies almost completely upon himself. Once more it is necesary to suggest that these stages are merely roughly implied in the variations of existing practice.

Most of the methods discussed in this chapter have had as their sanction the attainment of accuracy in thinking and calculating. Some efforts to insure independent power on the part of the child have already been noted. But nothing has been said of the effort to add speed to accuracy in getting efficient results. Such special efforts have been made. These efforts may be classified into two groups: (1) Those aiming to quicken the rate of mental response. (2) Those aiming at short-cut processes of calculation.

Typical of the first are (*a*) the use of an established rhythm as the child attacks a column of additions; (*b*) the device of having children race for quick answers, having them raise their hands or stand when they have gotten the answer; (*c*) the assignment of a series of problems for written work under the pressure of a restricted time allotment for the performance of each. These and similar devices are much used in the schools. They are open to the objection that they quicken the rate of the better students, but foster confusion, error, and discouragement among the less able children, not infrequently, actually retarding speed.

The various shorter methods which represent the effort to reduce the number of mental processes required are usually not of general applicability, and consequently have not attained any general currency in the elementary schools, where the object is to teach one generally available and effective method, even though it requires more time, special expertness being left to later development in the special school of business which requires it.

It has come to be quite a common recognition of teachers that the fundamental element in rapid arithmetical work is certain and accurate work. If pupils know their tables of combinations and are sure of each detail of calculation, there is no confusion or hesitancy; speed then follows as a matter of course. This belief, as much as anything else, explains why the lower schools have developed few special means for attaining speed apart from those already mentioned.

VIII. THE USE OF SPECIAL ALGORISMS, ORAL FORMS, AND WRITTEN ARRANGEMENTS.

The methods of teaching arithmetic are influenced not only by the aims of such instruction, but by the peculiar nature of the matter taught. The use of special algorisms, temporary algoristic aids or teaching "crutches," oral and written forms of analysis are of considerable moment in determining the difficulties and therefore the methods of teaching. Their condition and influence will need to be given some slight notice.

The use of special and temporary algoristic aids or learning "crutches" in mathematical calculation is one of the problems of method under constant controversy. Teachers seem fairly evenly divided upon the question. Typical situations in which such "crutches" are used may be noted as follows: Changing the figures of the upper number in "borrowing" in subtraction; rewriting figures in adding and subtracting fractions, in the broad sense any algorism which is used during the teaching or learning process temporarily, to be abandoned completely later, is an "accessory algorism" or "crutch." The objections to their use lie in the fact (1) that skill in manipulation is learned in connection with stages and forms not characteristic of final practical use; (2) that this implies, psychologically at any rate, the waste of learning two forms or usages instead of one; and (3) that it decreases the speed with which mathematical calculation is done. If there is a drift in any direction, it is probably toward the abandonment of "crutches."

The division of opinion, which exists in connection with the temporary use of special algorisms or "crutches," likewise exists with reference to the use of "full forms" and "short forms" of manipulation and statement. The temporary use of a "full form," in a case where a "short form" will finally be used, is similar to the employment of a "crutch." There is one important difference, however, which explains the relatively larger presence of temporary "full forms" than of "crutches." The "full form" is an accurate form which is used somewhere, in a more complex stage of the same process or in some other process; the "crutch" is not. Thus, a "full form," in column addition (with partial totals and a final total of partial totals) will be utilized in column multiplication; the "long-division form" of doing "short division" (that is the fully expressed form of dividing by a number of one figure) will be utilized in division by numbers of more than one figure.

The problem of form applies not alone to the algorism or special method of computation, but it likewise applies to the special methods of reasoning used in determining the specific series of steps to be taken in achieving the answer. In every problem the child solves he must not only decide what is to be done (reason), but he must do it (calculate). There are forms of reasoning as there are forms of calculation. As any calculation may have several algorisms the solution of a problem may be expressed in several forms. It is the latter difficulty which appears in the teacher's demands for "formal analysis" of problems. The analysis is usually required in full statement.

A conservative protest against the old formal expression of reasoned steps is found in omitting for the most part the linguistic statements dealing with the logic of the problem and merely "labeling" the numbers that occur in the calculation. This is a more restricted form of statement, much more used at the present time than hitherto. But it is still open to psychological objections that make the more scientific critics protest. There are many stages in a calculation where there is no association whatever with the concrete problem in hand. The concrete problem is studied, the decision is made that all the factors named are to be added. They are added, purely abstractly, and a number is given as the total. The result is then thought of in terms of the concrete problem in hand. A disposition to label each item in the addition may be necessary in the rendering of a bill, but it is a false and obstructing activity in the actual solving of the problem. The same situation exists where there are two or three processes to be utilized in series. Once the child has grasped his concrete situation and reasoned what to do he may proceed to mechanical manipulation, never thinking of the concrete applications till he is done.

The same tendency which is making for a reduction of verbal forms is increasing the use of mathematical symbols. As logical relations are less frequently written out, a simple sign such as + or ÷ is used. The algebraic x is supplied in place of a whole roundabout series of awkward preliminary statements or assumptions. With it, of course, come changed methods of manipulation, as in the use of the algebraic equation.

It is doubtless true that the rigidity of full logical forms is giving way to a more flexible and natural mode of expressing the child's thoughts. Fixed oral and written forms of exposition may assist the child, much as the acquisition of a definite symbol fixes an abstract meaning, which remains unwieldly until it attaches itself to a word by which it is to be recalled. But increasing care is manifested that children shall use only those forms that will conform to practical need upon the one hand, and to natural, efficient, and economy mastery on the other.

IX. EXAMPLES AND PROBLEMS.

The teaching of arithmetic is usually classified under two aspects, formal work and applied work. The formal work deals mainly with the memorization of fundamental facts, processes, and other details of manipulation. The applied work, as the name implies, is the formal work utilized in the setting of a concrete situation demanding a solution. These two aspects of arithmetical instruction are very frequently sharply separated, the child working alternately with one or the other. The characteristic practice is to deal with them without relating them as closely as the highest efficiency would demand.

Formal exercises in arithmetic are usually presented through the "example;" the exercises in application through the "problem;" the distinction being that one is an abstract and symbolical statement of numerical facts and the other a concrete and descriptive statement.[1] In the first case the mathematical sign tells the child what to do, whether to add, subtract, multiply, or divide; the example being a kind of prereasoned problem, the child has only to manipulate according to the sign, his whole attention throughout being focused on the formal calculation. In the second case the child has two distinct functions: He must, from the description of the situation presented, decide, through the process of reasoning, what he is to do (add, subtract, divide or multiply), and, having rendered his judgment, he must proceed through the formal calculation.

As the problem involves two types of mental processes in a single exercise, and the example but one, the usual procedure in arithmetic is to take up the formal side through examples first and, later on, the applied side through the use of problems. This means that the first emphasis is on formal and abstract work rather than on a treatment of natural, concrete situations, an emphasis not wholly sanctioned by modern psychology and the better teaching procedure of other subjects.

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[1] While this distinction is not general, it has sufficient currency to warrant its use here for the convenience of discussion. The expression "clothed problem" (from the German) is occasionally used to mean what is here designated as "problem," and "abstract problem" is used to mean what is here designated, as "example."

The reform tendency is found mainly in the primary grades where the beginnings of new processes are made through objective presentations of the problem. But the transition from objectified problems to formal work is not immediate. The children pass from objectified situations to "number stories," which are only descriptions or narratives of a situation. This is the interesting primary-school equivalent of that more businesslike language description found in the higher grades—the arithmetical problem. But it precedes formal work and succeeds it, the formal drill being a mere intermediate drill. Here concrete presentations and formal work are more closely related and more naturally ordered.

This reform tendency, which began in the primary school, is extending to the higher grades, where it is no longer rare to find the attack upon a process preceded by careful studies of the concrete circumstances in which the process is utilized. In the case of interest, several days might be utilized in studying the institution of banking in all its more important facts and relations. Such an approach not only provides motive for the formal and mechanical work, but it gives a necessary logical basis in facts. Hence, the understanding of practical business life makes accurate reasoning possible for the child when he is called upon to solve actual problems in application of the formal work.

It is perfectly natural under the general traditional practice of putting the first emphasis on mastery of the formal work that the largest amount of attention should be given to the mechanical and technical side of arithmetic, and that the concrete uses and applications should be slighted, and this is generally true of the practice of American teachers. Much more ingenuity has been used in the careful training of the child on the formal side than in teaching him to think out his problems. There is no such careful arranging and ordering of types in teaching a child to reason, as there is in teaching him to calculate.

Here and there a few thoroughly systematic attempts are made to carry the pupil through the simple types of one-step reasoning, to two-step and three-step problems with their possible variations. Just as the example isolates the difficulties of calculation, by letting the sign of + or — stand for the logic of the situation, there is a tendency to give problems without requiring the calculations. This affords a means of isolating and treating the special difficulties of reasoning. The child is merely required to tell what he would do, without doing it; the answer being checked by the gross facts. A little later, as a transition, he is permitted to give a rapid, rough approximation of what the answer is likely to be. With further command he tells what he would do and does it accurately. But such a program of teaching is still rare among teachers.

The care of the child's reasoning is largely restricted to testing his comprehension of the problem (1) by having him restate the problem to be sure he understands it, or (2) by having him give a formal oral or written analysis of the way in which he solves the problem. The first requirement may not be thoroughgoing, as the child may give a verbal repetition of the problem without really knowing its meaning. The second is a formal analysis of the finished result and does not represent the genetic method of the child's thinking. Consequently its formulas do not in any considerable degree assist him in his actual struggle with the complex of facts.

This lack of a systematic teaching of the technique of reasoning is manifest in the unreliability of children's thinking. When a child fails in a problem assigned from the textbook, the source of the error may be in one or more of three phases: (1) In failing to get the meaning of the language used to describe the details of the situation; (2) in failing to reason out what needs to be done to solve the situation; (3) in failing to make an accurate calculation. The first is a matter of language; the second, one of reasoning; the third, of memorization. The elimination of errors, due to the first and third sources, leaves a considerable proportion to be accounted for by the second. Such informal investigations as have been made seem to show that the children who fail in reasoning do not make any real effort to penetrate into the essential relations of the situation. They depend on their association of processes with specific words of relation used in the description of the problem, an association determined, of course, by their past experiences. As long as these familiar "cue" words are used, they succeed. Let unfamiliar words or phrases be utilized in their stead or let the relation be implied, and, like as not, the children will fail to do the right thing. Practical school people are familiar with the fact that children solve the problems given in the language of their own teachers and fail when the problems are set by principals or superintendents, whose language is strange to them.

A greater use of varied objects in the objective presentation of problems, and a more constantly varied use of language in the descriptive presentation of problems would prevent the child making such superficial and unthoughtful associations, and force him to think out connections between what is essential in a typical problem and the appropriate process of manipulating it. But such a deliberate application of modern psychology is far from being a conspicuous minority movement. The subject matter of the problems given to children has, however, improved greatly. Obsolete, puzzling, and unreal situations which only hinder the child's attempt to reason are less and less used in problem work.

Daily it becomes recognized with greater clearness that right reasoning depends upon a comprehension of the facts of the case, and the facts of the case in point must be within the experience of the child. This is the only way in which a problem can be real and concrete to him.

The recent effort on the part of textbook writers and teachers to make arithmetical problems "real" and "concrete" has not always recognized the above-mentioned psychological principle. The terms "real" and "concrete" have been interpreted in many ways, besides in terms of the child's consciousness. With some, "real" has meant "material," and the problems, more particularly with primary children, have, in increasing degree, been presented by objects or words connoting very vivid images. Others have defined these qualities in terms of actual existence or use in the larger social world. If these problems actually occur at the grocer's, the banker's, or the wholesaler's, it is said that they "are indeed concrete." And much effort has been expended in carrying these current problems into the classroom, in spite of the fact that they may be neither comprehensible nor interesting to the pupil.

There is another social world, nearer home to the child, from which a more vital borrowing can be made. There is an opportunity to use the child's life in its quantitative aspects, to take his plays, games, and occupations, and introduce their situations into his mathematical teaching. As his world expands from year to year he will be carried by degrees from personal and local situations to those of general interest. The teacher can provide this progression without devitalizing the facts presented.

There is another error into which both the socially minded radical and the specialist in child study fall. In their eagerness to improve the arithmetic problem, they assume that problems taken from the larger social world or from the child's experience are necessarily superior to hypothetical, imaginative, or "made-up" problems. The psychological fact that needs to be forced upon the attention of the reformers is that, with proper artfulness, an imagined problem may be even more vital and real to the child than one taken from life—as a situation in a drama may be more appealing and real to a child than one on the street. This has some recognition, but not enough. Those who stand upon the side of the "made-up" problems are more likely to be reactionaries who tolerate the traditional type of problem even though its stupid artificiality is obvious to both the teacher and the child. They might better be dealing with dull problems borrowed from real life than with specially invented dullness.

Of course there is another argument for the use of actual social materials. The child must ultimately come into command of precisely these facts, since their mastery will be demanded by the business world. But must a primary school child study his arithmetic through problems taken from the dreary statistics of imports and exports merely because tariff reform is a political issue which every citizen ought finally to comprehend? There is a time for this, and, as is the case with most of such borrowed business problems, the time is later. In so far as these are current situations within the contacts of child life, let them enter. A quantitative revelation of life is important, and it is good teaching economy to gain knowledge by the way, provided it does not distract attention from whatever main business is at hand.

The socializing of arithmetical problems has one other additional good effect. It has tended to bring some topical unity into the problems constituting the assignment for a given lesson or group of lessons. Hitherto a series of problems was almost always composed of a heterogeneous lot of situations. There was no unity save that some one process was involved in each. The movement is now in the direction of attaining a more approximate unity within the subject matter of the problems themselves. The difficulties of attainment have restricted this movement to more progressive circles.

The eclectic source of arithmetic problems is apparent from the foregoing discussion. It would seem that some better texts would naturally be evolved through the implied criticism of each movement upon the other. Such is the case. Problems from child life emphasize the beginning condition to which adjustment must be made in all good teaching. Those from the greater world suggest the final goals of instruction. Those "made up" by the teacher call attention to what is too often forgotten, that the educative process in school may be artful without becoming artificial. Teaching is art, and when well done is not less effective for the fact.

X. CHARACTERISTIC MODES OF PROGRESS IN TEACHING METHODS.

The existing methods of teaching arithmetic in the American elementary schools are exceedingly varied. This is due to many causes. The democratic system of local control, as opposed to a centralized supervision of schools, has increased both the possibility and the probability of variation. Even within the units of supervision (State, county, and municipal) the opportunity for reducing variation in the direction of a more efficient uniformity is lost. This is partly due to the lack of a thoroughly trained staff of supervisors of the teaching process. Uniformity beyond the legal units of supervision has been restricted by the lack of organized professional means for investigation of and experimentation in controversial matters. Even such crude experiments as are being tried in more than one classroom, school, or system are unknown, unreported, unestimated, because no competent professional body gathers, evaluates, and diffuses such knowledge. In this respect the teaching profession is far below the efficient organization of the legal and medical professions.

It is exceedingly difficult, therefore, to analyze the characteristic aspects of teaching method except as these are interpreted in movements of general significance. These may be actual or potential, traditional or reformatory, general or local, in present acceptance. The situation is one wherein tradition is mixed with radicalism, and radicalism modified by reaction. In this medley of movements there are dominant tendencies both traditional and progressive.

It is quite impossible to indicate the progressive tendencies with clearness save in connection with the discussions of concrete difficulties in mathematical teaching. The forces that are behind these tendencies may, however, be summarized here. For convenience they may be classified into eight types of influence, extending from more or less vague and general movements to very particular scientific contributions. No attempt is made to indicate the achievement of each; the form of each influence is only roughly defined and illustrative movements or studies suggested.

1. It is obvious that any general pedagogical movement which influences the professional attitude of teachers will influence the special methods of mathematical teaching. The appearance of the doctrine of interest made mathematical instruction less formal. The growing enthusiasm for objective work enlarged the use of objects in the arithmetic period. The child-study movement laid emphasis upon the child's own plays and games as a source of problems and examples.

2. Certain special movements in methods of teaching, local to the subject of mathematics, have also been effective. Here one has only to recall the "Grube" method, with its influence on the order and thoroughness with which the elements of arithmetic are taught.

3. The tendency of every teacher who is at all sensitive to the defects of his methods is to vary his daily practice. Constant trial, with error eliminating and success justifying a departure, is thus a source of progress. The new devices of one teacher are taken up by the eager professional witness and innovation is thus diffused. We have no ability to measure how much professional progress is due to individual variation in teaching and its conscious and unconscious imitation. The disposition of school systems to send their teachers on tours of visitation without loss of salary is a recognition of the value of this method of advance.

4. A far more efficient and radical source of change than that just mentioned is the deliberate, conscious, experimental teaching of progressive individuals. Some new idea or device occurs to the reader of original mind, and it is tried out with a fair proportion of resulting successes. An illustration of such a contribution is found in

one conspicuous effort to get more rapid column addition. The first columns to be added were allowed to determine the selection and order of addition combinations learned. Thus, if 6+7+9+6+7=35, is the first column to be used, then the first combinations mastered will be 6+7=13, 3+9=12, 2+6=8, 8+7=15. Arising as a fruitful idea and seeming to give a measure of success, it has been carried, in the particular locality in mind, from school to school, and from system to system.

5. A prolific source of radical change is found in the critical application of modern psychology to teaching methods. Algorisms, types of difficulty, the order and gradation of these, as well as many other factors in method have been radically reorganized on psychological grounds. Examples of such psychological modifications of method are found in the "Courses of study for the day elementary schools of the city of San Francisco." Still more extensive critical applications are found in the "Exercises in arithmetic" devised by Dr. E. L. Thorndike, professor of educational psychology in the Teachers College, Columbia University.

6. Attempts have been made to inquire into the special psychology of arithmetical processes through careful experimentation and control. They have not been numerous, nor have they been influential on current practice. Such a field needs development. A typical attempt to investigate and formulate the special psychology of number is found in a Clark University study of "Number and its application psychologically considered."[1]

7. Educational investigations as to the efficiency of existing arithmetical teaching among school systems, sufficiently varied to be representative of American practice, have also been conducted. These have usually gone beyond the field of the special methods of presentation employed in the classroom, and have inquired into the conditions of administration and supervision, the arrangement of the courses of study, and other similar factors. Dr. J. M. Rice's studies into "The causes of success and failure in arithmetic"[2] investigated such specific factors as: The environment from which children come, their age, time allotment of the subject, period of school day given to arithmetic, arrangement of home work, standards, examinations, etc. A subsequent study of similar type, but employing more refined methods is that of Dr. C. W. Stone on "Arithmetical abilities and some factors determining them."[3] The main problem of this study was to find the correlation between types of arithmetical ability and

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[1] Phillips, D. E. Number and its application psychologically considered. Pedagogical Seminary, vol. 5: 221–281, 1897–98.

[2] Rice, J. M. Educational research; Causes of success and failure in schools. Forum, 34: 281–297, 437–452, 1902–3.

[3] Stone, C. W. Arithmetical abilities ad some factors determining them. Columbia University contributions to education, Teachers College, New York City, 1908, pp. 101.

different time expenditures and courses of study. These two studies have probably attracted more general notice than any other studies of arithmetical instruction. While they have largely dealt with administrative conditions that limit teaching method, rather than with the details of teaching method itself, they have stimulated the impulse to investigate conditions and practices of every type.

8. The latest source of progress in teaching method is found in the movement for comparative experimental teaching under normal but carefully controlled conditions. Several such experiments are being conducted in the Horace Mann Elementary School of Teachers College, Columbia University, under the direction of Principal Henry C. Pearson, with the cooperation of the staff of Teachers College. The experimental work conducted by the instructors and students of the Teachers College is primarily designed to determine the relative value of competing methods in actual use throughout the country, the assumption being that every substantial difference in practice implies a difference of theory and consequently a controversy that can be resolved only on the basis of careful comparative tests. Two parallel series of classes of about the same age, ability, teacher equipment, etc., are selected for this work. One series is taught by one method; the other series by the other method. The abilities of these children is measured both before and after the teaching, and the growth compared. The standards and methods of this type of comparative experimentation, together with a list of current competitive methods requiring investigation, is given in Dr. David Eugene Smith's monograph on "The teaching of arithmetic."[1]

SUBCOMMITTEE 4. PREPARATION OF TEACHERS FOR GRADES ONE TO SIX.

INTRODUCTION.

The fact that mathematical instruction in elementary schools is so universally given by teachers who teach most of the other elementary school subjects also, makes it difficult to isolate many of the specific elements of preparation entering into training for mathematics teaching. Departmental instruction below the seventh grade in mathematics is so rare as to be exceptional. The general preparation for mathematics teaching in the first six grades of the elementary school is therefore very largely included in that general foundation work which includes courses in psychology, the principles of teaching, and the principles and history of education, together with observation and teaching under supervision and criticism in a training or practice school. Besides this general type of pedagogical preparation, most normal schools and other training schools for teachers usually offer courses in "special methods" in teaching elementary mathematics, these courses furnishing practically all of that training which may be regarded as specific for the subject. The "special methods" course is usually given by an instructor who also teaches classes in secondary mathematics—advanced arithmetic, algebra, geometry, and occasionally trigonometry, or even more advanced courses which are offered as electives in a very few normal schools. In the larger schools, the head of the department may be assisted in this instruction, but he, himself, usually gives the work in "methods." The character of this work and the professional attitude of the instructors vary in a degree that makes generalizations relative to them almost impossible. The instructor may regard the "methods course" as simply a means for reviewing subject matter and the training school work as a sort of nuisance or as having no relation to his department, or he may give the course over almost wholly to questions of the psychology and pedagogy of mathematics teaching, using the training school constantly as a laboratory for instruction, demonstration, and experimentation.

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[1] Smith, D. E. The teaching of arithmetic. Chap. XVI, Teachers College, January, 1909.

Until the rapid development of normal schools within the last quarter of a century, in common with all other elementary school subjects, the only preparation required for teaching mathematics in the elementary school was such a course in elementary arithmetic as would enable the candidate to pass a relatively simple examination set by a county or city superintendent or a board of school directors. Even to-day, in most of the rural and village communities of this country, this is the method of providing teachers. These teachers have no academic preparation beyond the subject matter which they expect to teach, and no professional training at all. However, the rapid development of State normal schools and of city training schools has brought about a standard for teachers, adopted as fast as the supply will permit, of much higher academic preparation together with a minimum approximating two years of professional training. In this general advance of standards, mathematics has received a share of attention, although perhaps tradition has offered a handicap which has not been felt by the newer subjects in such a large degree. But within the last decade the whole subject of the teaching of mathematics has come to receive the attention which it justly deserves. Yet, with all of the discussion which has developed, there is very little literature that deals specifically with the problem of present-day theory and practice in the preparation of teachers for the elementary school. The committee secured data for its conclusions by direct inquiry of typically representative normal schools and city training schools. By geographical distribution, 19.5 per cent of these schools are in the Atlantic States, 21.9 per cent in the Pacific and Mountain States, and 58.5 per cent in the States lying between these groups. The inquiry concerned itself specifically with the amount required of prospective teachers in the subject matter of mathematics, the amount and kind of professional study, the relation of the department of mathematics to the training or practice school, and suggestions of constructive improvemnt or reform.

SUBJECT-MATTER COURSES.

For normal schools regarded as standard, as well as for city training schools, high-school graduation seems almost a fixed norm for the whole country as an entrance requirement. In mathematics it is usually assumed that students have had a high-school course in arithmetic of one term or semester, one year or more of algebra, and one year of geometry, usually plane. In some normal schools arithmetic is required of students " found wanting " in its subject matter. In many schools solid geometry, advanced arithmetic, advanced algebra, and trigonometry are offered as electives.

It is thus apparent that the teacher of mathematics in the first six grades has a knowledge of subject matter in formal mathematics far beyond any of the actual needs arising within these grades. That this knowledge of subjects beyond elementary arithmetic functions in the teaching of the arithmetic it would be very difficult to show. The formal and isolated character of the work in algebra and geometry, as they are usually taught, leaves them barren of any content values having a bearing upon anything which appears in the usual work of the first six grades. Even in the best normal schools there is little evidence that the work in algebra and geometry is any less academic than in the classical high schools. In the normal school "humanistic" values should certainly most fully reveal themselves.

PROFESSIONAL COURSES.

The professional courses and work include a course in arithmetic "methods" or in arithmetic with some attention to methods in all normal schools, observation and practice teaching in some form in most of them, and a course in the history of mathematics in 4.8 per cent of them.

The course in arithmetic "methods" is given during one semester in 73 per cent of the schools. In a few, not more than 10 per cent, it is given during but half a semester—from six to nine weeks. The character of this work differs markedly. In 27 per cent of the schools the work is largely a review of the subject matter of arithmetic, method being merely incidental. Over 14 per cent give practically the whole time to method. With others it varies from one-tenth to one-half of the time.

In the methods work itself 41 per cent of the schools require the organization of definite units of subject matter for presentation in the grades and the writing of specific lesson plans as a part of the work. In a like number definite study is made of the elementary course of study as a whole. Games and recreational devices for motivation and drill are considered in 53 per cent of the schools. Forty-one per cent of the schools make some use of current literature on the teaching of mathematics, although one instructor replies that he does not, as "there is little in it that is useful." Other instructors indicate that they value the periodical literature as growing increasingly helpful and suggestive for their own work. Some form of mathematical museum is found in 34 per cent of the schools. This varies from "a small private collection" to rather pretentious collections of textbooks, periodical essays and addresses, illustrative apparatus and models, and standards of weights and measures of various kinds.

Observation of schoolroom teaching as a part of the work in methods is found in 46 per cent of the schools. The time devoted to observation varies from "three or four lessons a term" to "one-third of the course." In 7 per cent of the schools all observation work is in connection with practice teaching. The place and value of systematic, purposeful observation seem to vary greatly in the minds of instructors. That the lessons observed should be well taught, model lessons, is indicated by the fact that in 47.3 per cent of the schools definitely using observation the lessons are taught by critic teachers and in 36.8 per cent by the special mathematics teacher. The training school is used as a laboratory in the methods courses in 39 per cent of the schools. As schools of education which tend to furnish an increasing number of teachers prepared for normal-school instruction in mathematics develop possibilities of the training schools as laboratories, this phase of work in the preparation of the elementary-school teacher will doubtless increase.

Practice teaching in arithmetic is required of all students who graduate from 39 per cent of these schools. In one school it is required in at least two grades. In most other schools students do practice work in but two or three subjects and may be graduated without any practice teaching in mathematics.

The somewhat isolated condition of the department of mathematics from the training school is shown by the fact that in only 39 per cent of the schools does the teacher of mathematics aid in the supervision of the subject in the training school and that in only 27 per cent does the department of mathematics make or partly make the course of study for the training school. Cooperation in the development of the course of study and in the supervision of the teaching of mathematics in the training school has been found to be of very high value in developing a professional attitude in the minds of prospective teachers through the multitude of live problems always before them and in whose solution they may participate.

More than 95 per cent of the schools discourage departmental work below the seventh grade. One school definitely advocates it from the fourth grade upward. A special type of training for primary teachers is provided in 24 per cent of the schools. Number work receives its proportion of attention in these primary methods courses when they are general in character. In 12 per cent of the schools there are specific courses in primary methods in number work.

From the suggestions for reform received from instructors, the following summary indicates the several types: "A better knowledge of subject matter." "Teaching to make subject matter vital." "Make the work closer to the children; more connection of the work with life." "Use more concrete examples; use more objective work." "Develop a more definite knowledge of practical applications." "Develop more work in the fundamental pedagogy of processes." "Develop a more definite idea of the relation of the work of each grade to the whole arithmetic course." "Develop a better knowledge of method." "The development of a good textbook in simple method." "Require successful practice teaching in arithmetic for at least 10 weeks." "Make more of observation; observe more skilled teachers." "A general course for all, followed by a more intensive course for the particular grades in which the teacher is to work."

SUMMARY OF DATA.

From the foregoing data, it is evident that great differences in ideals and practice exist with reference to the following points: There is variation from method as a mere incident to subject matter to the use of full time for method in "methods" courses; from no use whatever of current literature on the teaching of mathematics to "very extensive" use of such literature; from no consideration of games and recreational devices to very careful consideration and testing of these; from no consideration of the course of study in arithmetic for the grades to the full development of such a course and the organization for presentation of certain of its units; from no mention at all of the history of the development and teaching of mathematics to the establishment of well-organized courses in this subject; from no observation of lessons in arithmetic in the grades in connection with methods courses to one observation lesson each week during the course; from no practice teaching at all required in mathematics to practice work in arithmetic for all in at least two grades; from no supervision of practice work and the teaching of mathematics in the training school by the teacher of mathematics to close, jointly responsible supervision with the grade supervisors; from positive discouraging of departmental teaching of mathematics in the grades to positive advocating of it in middle and upper grades; and from no differentiation in training for the grades to courses in detailed special methods for primary grades.

There are also evident the following points of general uniformity: Entrance requirements to methods courses in arithmetic are quite uniformly high-school courses of about one-half year's work in arithmetic, one year in algebra, and one-half year or one year in plane geometry. Some kind of methods or teacher's course in mathematics is found in all. Some form of observation work either in connection with the course in arithmetic methods or with general method or practice teaching is advocated by all. In general, departmental work below the seventh is discouraged. No school is fully satisfied with its present practice.

Suggestions for reform are of four types: Greater knowledge of subject matter; a reorganization of arithmetic material, giving it more vital relationship to the child's life and to social life; a more intelligent knowledge of the pedagogy of arithmetic; and a closer, more vital relationship between the department of mathematics and the teaching of arithmetic in the training school. Three ways are suggested for bringing about this last relationship: By more systematic observation of work in the grades, by more responsibility for the course of study and the methods of teaching in the grades, and by closer supervision of practice teaching in arithmetic by the department of mathematics.

CONSTRUCTIVE SUGGESTIONS.

From inferences based upon the foregoing, and from reflection upon the general problem, the committee believe that the best theory and practice of to-day point to the following conclusions: That a foundation in subject matter as a basis for the professional study of mathematics for teaching the subject in the first six grades of the elementary school should include a minimum of one-half year in high school arithmetic, one year of algebra, and one year of geometery; that, exclusive of all courses in psychology, pedagogy, principles of teaching, general method, or history of education, a minimum of one-half year's professional study of arithmetic should be required to include the following: A course in "special method," the teaching of elementary mathematics which should consider the more elementary phases of the psychology of number; principles of general method in their application to arithmetic; educational values of arithmetic and the place of arithmetic in the general educational scheme; the organization of the elementary school curriculum in arithmetic; the organization of typical units of subject matter for presentation to appropriate grades; the development and writing of typical plans for teaching; the utilization of local and general economic studies for number application; the observation and discussion of typical lessons in the grades showing concrete applications of principles developed; the place of games and other recreational devices in lower grade work in number, and the historical development of the teaching of arithmetic, showing the place and value of certain "methods," as the Grube, Speer, etc.

The committee believe, further, that every school engaged in the preparation of teachers of mathematics should develop a museum or teaching collection of materials—apparatus, books, pamphlets, papers, etc.—which will aid in interpreting the historic development of the subject, present day practice, textbooks, etc.; that the head of the department of mathematics should be largely responsible for the organization of the course of study in mathematics in the training school in cooperation with the department of education and the supervisors in the training school; that the head of the department of mathematics should aid in the supervision of the teaching of mathematics in the training school; and that he, as well as the supervisors or critic teachers, should be able to give demonstration lessons in the training school illustrative of principles of teaching developed in the "methods" class, and that the points of emphasis in all observations, discussions, plans, and criticisms should be upon the basis of fundamental principles rather than upon petty details.

The aim in the whole professional consideration of mathematics for teachers of these grades is, broadly, to give acquaintance with the fundamental principles of teaching arithmetic, of the organization of its subject matter, of its place in the educational scheme, and of its historic development. The teacher should be given the pedagogical outlook and perspective of arithmetic, as well as the ways and means of teaching its details. He should know enough of the psychology of number to enable him to secure healthy interest and adequate drill and to sacrifice neither at the expense of the other.

The greatest problem of all at the present time would seem to be to find teachers for departments of mathematics in normal schools who themselves have the wide pedagogical outlook desired for such work. When teachers can be found who have its larger perspective and who will regard the training school as the laboratory for developing insight, intelligence, and a minimum of skill in the teacher to be sent out into the field at large, this vital, daily union of theory and practice will do much to increase the efficiency of the prospective teacher in elementary mathematics.

SUBCOMMITTEE 5. MATHEMATICS IN GRADES SEVEN AND EIGHT OF THE PUBLIC AND PAROCHIAL SCHOOLS.

SCOPE OF THIS REPORT.

It was desired that this subcommittee make a special study of the following topics for grades seven and eight in public schools and in parochial schools: (*a*) The organization of the schools. (*b*) The mathematical curriculum in each type of school. (*c*) The question of examinations from the point of view of the schools. (*d*) The methods employed in the teaching of mathematics. (*e*) The parochial schools.

It was desired that the report present both present conditions and tendencies.

SOURCES OF INFORMATION.

In addition to general knowledge of the ground covered by this report, use has been made of the following sources of information: (*a*) The teaching of elementary mathematics. Prof. David Eugene Smith, Macmillan Co. (*b*) The teaching of arithmetic. Prof. David Eugene Smith, Teachers College Press. (*c*) The teaching of mathematics. Prof. J. W. A. Young, Longmans, Green & Co. (*d*) Courses of study of leading cities. (*e*) Responses to a questionnaire sent to leading cities.

DEFINITIONS OF TERMS.

The term elementary education is probably not as well defined as it might be. In general it is that education which by common practice is deemed desirable and necessary for preparation for the duties and rights of citizenship. It is made compulsory as a rule by the laws of the various States for children between the ages of 6 and 14 years. The term public as applied to schools is used to denote those schools which are conducted at the expense of and under the control of the various State and local political units; tuition in these schools is without expense. For a more complete discussion of the units see the report of the general committee number one. The term "grade" is used to denote each of certain divisions into which the work of the elementary schools is divided. As a rule there are eight such divisions. One school year of from 35 to 40 weeks is required for a pupil to complete the work of one grade, excepting that bright pupils are permitted to do the work in less time. In larger cities a year or two of preliminary (kindergarten) work for children between the ages 4 and 6 is sometimes given. The eight main divisions are called respectively the first grade, second grade, etc. In some parts of this country, notably New England, there is a slightly different division of the course. The function of this committee is to study the mathematical work in the last two grades of the elementary course.

SPECIAL INTEREST IN THESE GRADES.

There are several reasons for special interest in the work of these grades. The mathematical function of the first six grades is to give the pupils control over the mechanics of arithmetic, over the fundamental number, facts and processses. The function of the upper grades has not been as well defined. There are several influences at work affecting the whole curriculum of these two grades, and especially the mathematical course. The results of certain psychological studies are especially applicable here; these two grades comprise the last part of the compulsory education of the children; they precede the high school; they correspond with certain sections of the school course of European schools, which are included in the secondary curriculum.

INFLUENCE OF PSYCHOLOGICAL STUDIES.

No effort will be made to go into great detail on this point; attention will be directed briefly to certain conclusions reached by psychologists, which are especially effective in modifying the mathematical work.

The doctrine of formal discipline is accepted now in only a modified form so that it is no longer deemed sufficient to claim for any subject that it has great disciplinary value. The educational value of all subjects, including mathematics, has been and is being subjected to close scrutiny with the result that subjects and subject matter long retained in the curriculum, through regard for tradition, are being displaced by new material, equally valuable as means of training, but more representative of current life. When this is not the result, old material is frequently dropped without any such substitution, on the ground that it neither has valuable content nor is necessary as means of training. As in all reforms, there is a tendency to go to extremes in this, especially with regard to mathematics. The willingness of the mathematicians to subject their science to the test of the new doctrine has invited the less sympathetic scrutiny of others who are not interested in the subject. The result is a tendency to demand more of mathematics in this respect than of other subjects.

The doctrine of interest as essential in training the will is generally accepted as valid. Systematic efforts to study child life and needs have served to call attention to the special interests of children between the ages of 12 and 15 years, who are just entering the adolescent period of life. The importance of safeguarding nervous energy at this time is generally recognized; the need of training the hand and the eye along with the mind, the necessity of vital contact with new material rather than theoretical study as a basis of real interest and comprehension are among the results of this movement.

INFLUENCE OF COMPLETION OF ELEMENTARY COURSE.

A large majority of the pupils of the schools do not go on to high school after completing the eighth grade. There are many reasons for this. The laws of most States do not permit the employment of children under 14 who have failed to complete the eighth grade. Many who are kept in school thereby avail themselves of the opportunity to seek employment as soon as they have completed the grade. In many cases the need of getting employment is urgent; in others, the opportunity to do so, the fact that the organization of the schools makes completion of the eighth grade a definite scholastic achievement, and the interests of pupils at this age lead many children to leave, even when their parents are in financial position to send them to high school. Many parents and pupils feel that the next stage of education is dominated too much by cultural ideals of education of so general a nature that the pupils are not trained for any form of remunerative employment. As evidence of this belief one may point to the large number of pupils who have graduated from the eighth grade who attend private schools where tuition is charged, called commercial schools, and to the fact that new forms of secondary education which have been provided in some localities seem to meet a real demand without in any way decreasing the demand for the customary forms of secondary education. For these various reasons there is a large shrinkage in the school population in the passage from the eighth grade to the high school.

Those in control of the educational work of the country are more and more allowing this fact to influence the course of study in the seventh and eighth grades. There is increasing emphasis on such training as will definitely equip the graduates for their future lives as individuals and as citizens of the community. Forms of manual training are provided and commonly, when it is impossible to furnish the equipment for all of the grades, provision is made for the pupils of the two upper grades. Owing to the realization that this vocational training is inadequate, there is at present a growing interest in industrial training. This movement which is destined to spread is certain to have its effect upon the mathematical work of the seventh and eighth grades.

INFLUENCE OF PREPARATION FOR HIGH SCHOOL.

It has been mentioned that many pupils who are ready for the high school fail to enter. It has been felt that some pupils might be led to go on to the high school if they could have in the eighth grade the beginnings of some of the high school subjects. For this reason, Latin, algebra, and a modified English course are urged as desirable eighth grade work in the hope that pupils will be unwilling to discontinue these subjects after they have once started them. In more recent years there is a reaction against this plan on the ground that these subjects are not properly within the scope of elementary education as defined. At the present time there are the beginnings of a new administrative policy to accomplish the same end. Schools are being provided in some of the systems which are designed for pupils who do plan to go on to high school or whose parents wish them to have this relatively more academic training. In these schools algebra will easily find a place. It is likely that the future will see a growth of this idea.

Again, for various reasons, the pupils who enter the high school find the work of the first year unusually difficult, so that many of them leave school during this period. It has become customary on this account to speak of the "gap" between the eighth grade and the high school, and it is generally admitted that better articulation is necessary there. The efforts to "bridge the gap" have included attempts to modify the work both in first year high school and in the eighth grade. In the eighth grade there has been an effort to concentrate upon essentials of arithmetic on the one hand, and on the other to prepare the pupils for high-school work by introducing the beginnings of algebra into the eighth grade work. There are two tendencies to-day which are likely to lessen the influence of preparation for high school as a modifying force in the eighth grade; first, there is the spirit of independence which characterizes the efforts of each of the larger units of the educational system, as an evidence of which in the elementary school is the belief that their main function is not that of serving as a feeder for the high school; and second, the spirit of responsibility on the part of each unit to take up its work where the previous unit has left off. This latter tendency is much more noticeable among secondary mathematics teachers than formerly.

INFLUENCE OF EUROPEAN CURRICULA.

The object lesson of European schools which provide under one administrative unit educational facilities for children from the age of 9 or 10 to 19 or 20, inclusive, has furnished considerable support for the idea that the essentials of elementary school work should be completed in a shorter time so that pupils may be started upon their secondary education at an earlier age. This has been urged, especially in mathematics, where it means a change particularly in the upper grades. This idea received the support of the committee of fifteen and the committee of ten of the National Education Association.

While four influences have been enumerated, it is clear that each affects the others, so that they are not independent. In particular this last is intimately associated with the preceding one. These two in a sense are antagonistic to the other two since these place the emphasis upon secondary education, while the others throw emphasis upon the elementary phase of education. The last two are still in favor among the schoolmen especially, as in the past, whereas the former are supported equally by public opinion.

RURAL AND PRIVATE SCHOOLS.

The schools of the rural districts do not feel all of these influences as strongly as do the urban schools. There is a growing effort to adapt the rural schools to the needs of the community, a movement identical with that noted in connection with urban schools. There is strong feeling of the importance of directing attention to the advantages of agricultural life. This influence will increasingly affect the work of the upper grades.

In private nonparochial schools the influences mentioned in paragraphs 7 and 8 are especially potent. The pupils of these schools usually go to the high school and college. In parochial schools there is usually reflected some of the educational policy of the public schools, in addition to the special educational policy of the parochial school. In the eighth grade of parochial schools the special function of these schools reaches its consummation in the specific training of the pupils in such sectarian studies as enable them to enter the church with which the school is connected.

ORGANIZATION OF THE GRADES.

In organization there is nothing particularly distinctive about the seventh and eighth grades. In their relation to the grades below they come under the general school administration which controls the first eight grades. For a discussion of this organization see the report of the committee on general elementary schools. In their relation to the schools above there is some difference. At the close of the eighth grade the pupils are usually given a diploma as a sign of having completed a definite stage of their education. This diploma as a rule entitles the holder to admission to the high school of the same system and usually of any other school system. The diploma is obtained after compliance with the ordinary requirements for promotion. Promotion is determined by the teacher of the class with certain requirements in the way of examination, which will be discussed in a later paragraph. In some cases a special examination is required before a pupil is promoted to the high school.

THE MATHEMATICS CURRICULUM.

There is a lack of uniformity in the curricula in these two grades greater than in the lower grades. Two classes of curricula must be considered: (*a*) Those which do not provide any work in algebra and geometry; (*b*) those which do provide such work.

For those schools which do not provide any algebra in the eighth grade (and in the country at large these schools are in the majority), the mathematics course may be arranged on the topical plan, the spiral plan, or a combination of the two. By a topical plan is meant one in which the subject matter is divided according to mathematical topics; numeration, notation, and the four fundamental operations are discussed in order for integers, then the same topics for fractions in the common form; then for fractions in the decimal form; then percentage; then the applications of percentage to business life. By a spiral plan is meant one in which within a given range of numbers, say one to one hundred, notation, numeration, and certain processes are considered; later the range of numbers, the kind of numbers, the processes, and the difficulty of the applications are extended repeatedly. By a combination of the two plans is meant a course in which, while the spiral plan is adopted in spirit, at various stages of the course certain mathematical ideas are stressed so that thereafter they may be counted on as part of the working knowledge of the class, subject to recall after only slight review.

In the past the topical plan has been especially in vogue; at the present time more progressive courses of study are modeled after the third plan; the second plan has had some support, but has never had very general favor. It is probably true that the topical plan in its extreme form or in a modified form is the common plan in the majority of the schools of the country. By a modified form is meant that typified by a series of texts consisting of two or three books designed to furnish together the necessary material for an eight years' course. Each text usually covers the fundamental operations for integers, fractions, and decimals, with additional topics in each book. One book is to be used for from two to four years.

Usually the mathematics course is guided by such a text. In this event the pupils learn in the first six grades the fundamental processes for integers, fractions, and decimals, and denominate numbers. The work of the seventh and eighth grades consists of the following: A review of this foundation work; special attention to percentage and its most common application, simple interest; other business application of percentage; mensuration of plane and solid figures. The list of applications of percentage includes such topics as bank accounts, partial payments, commercial and bank discount, partnership, insurance, taxes, stocks and bonds, exchange, and interest. In mensuration is included the discussion of the area and the volume of the common plane and solid figures, square, and cube root. Besides these topics, the metric system, longitude and time, ratio, and proportion are commonly included in the texts. On account of the influences noted in former paragraphs, the tendency in the better schools of the country is to work for thoroughness and utility by omitting such topics as partial payments, partnership, exchange, bank discount on interest-bearing notes, the more difficult work in stocks and bonds, longitude and time, some portions of the mensuration of solids, cube root, and the metric system. In short, there is great freedom in omitting such topics as are not in harmony with modern life or as have been found unnecessarily confusing for the pupils. The time thus gained is devoted to the remaining topics and to additional drill on the essentials.

The problem material is contained as a rule in the book which each pupil possesses. These texts are written for the country at large, not to suit local conditions. The problems are designed to illustrate the particular mathematical idea or application under discussion; they are usually miscellaneous in character. The influences noted in former paragraphs are responsible for a new attitude toward the problem material. An effort is now made to have one set of ideas running through a particular set of problems. For example, the arithmetical idea being discussed may be percentage; instead of giving as problems a miscellaneous lot of applications of the percentage idea, the problems may all be based upon information about the population of the country for a period of years. In other words, the problem material possesses a certain unity, as a result of which information is conveyed to the pupils on the subject from which the material is drawn. A second characteristic of the problems now coming into use is that they are selected so as to give the children some insight into industrial, business, and social conditions of the city, the State, and the country. Thus there are groups of problems about the railroad, the mining, the agricultural, the manufacturing interests; about the population, area, and the wealth of the city, the State, the Nation; problems drawn from the local newspaper; problems involving the local tax rate, local real estate values, local interest, discount and commission rates, the stocks and bonds of local corporations. This material the teachers must place before the pupils either orally or on the blackboard, although some school boards are issuing pamphlets containing these supplementary problems for use in their own schools. This is a serious attempt to socialize arithmetic. It makes the course consist less of figuring and more of discussion. Under banking for example, the nature, function, and conduct of a bank is discussed; under stocks and bonds, effort is made to show again the kinds, purpose, value, and manner of sale of bonds and stocks; under taxes, the various purposes for which taxes are collected and the sources from which they are obtained. The content of the problems is considered quite as important as the solution of the problems.

COURSES CONTAINING ALGEBRA.

The other type of course in mathematics includes some work in algebra, and sometimes in geometry. These courses vary even more than those discussed previously, because the work is relatively new. In some places the arithmetic work of these two grades is curtailed and condensed so as to be completed entirely by the end of the seventh grade or by the end of the first half of the eighth grade, the latter being the more common plan; the remaining time is then devoted to algebra. In other places, work in algebra is introduced into the seventh and eighth or the eighth grade without dropping the arithmetic; there is in this case little effort to bring about any vital connection between the two subjects; the time is merely distributed so as to cover the two subjects. Again, in a few places, an effort is made to introduce the algebra into the arithmetic course in a natural way.

When algebra is taught in either of the first two ways, the work is guided by a text. This text is in some cases a brief elementary algebra written for the eighth grade classes, or consists of a few chapters added on to the arithmetic text. As a rule, the sequence of topics covered is that of the usual high-school text. When the algebra is introduced in the third form, it is presented through the regular arithmetic text, where it is introduced as opportunity permits. For example, preceding the work in percentage, the first notions of literal numbers are introduced; then the percentage law is expressed as a formula, $p = br$. Thereafter this formula is used in the solution of problems, for example, such as require the determination of the rate when the base and the percentage are given. Later this literal arithmetic may be extended, although it is quite clear that no very extended amount of algebra can be introduced in this natural manner.

So far an attempt has been made to present briefly the various forms in which algebra is taught in the grades. No definite statistics are available to form the basis of a definite statement as to the prevalence of the teaching of algebra. One investigation showed that about 30 to 35 per cent of the schools of a certain class taught algebra and these were schools of the larger cities; taking the country at large, it is unlikely that more than this percentage of them teach the subject.

PURPOSE OF ALGEBRA IN THE GRADES.

Algebra was introduced into and is retained in the grades for a number of reasons. Some hoped thereby to interest some pupils in the subject to such an extent that they would be led to enter high school to complete it; others hoped that thereby the pupils who did enter high school would have a more successful time in their mathematics work—in other words, it was a device for "bridging the gap." With others, there was the desire to "abridge and enrich" the arithmetic course; after abridging it, they felt that the natural means for maintaining the mathematical element in the curriculum was to introduce the next higher mathematical subject, which happened to be algebra. It was hoped by some that the use of the literal number and of the equation would eliminate some of the difficulties the pupils experienced in analyzing and solving some of the arithmetic problems in the eighth grade course. Those interested in the mathematical element in education desired to carry to another stage of their logical generalization certain arithmetical ideas.

Two tendencies in regard to the position of algebra are to be noted.. With the public at large, the subject has never appeared as one of any "practical" value. With the current tendency to exalt in the schools those subjects which appear to have "practical" value is coming a feeling that algebra does not have a place in the eighth grade, especially in the form in which it has been taught. One of the largest cities of the country has recently entirely dropped it from the course, replacing it by the study of certain phases of local history and local business and industrial conditions. Another city, somewhat smaller in size but recognized as progressive in educational efforts has introduced about the same idea into its course, although there the next tendency to be mentioned has been recognized. These efforts, entirely independent, are typical of the feeling in some of our school systems.

The other tendency is toward an extension of the third plan of teaching algebra. There is in this country a growing belief that in the past too sharp lines of demarkation have existed between arithmetic, algebra, and geometry and there are efforts being made to bring the three into closer relation. In the elementary school, as early as the sixth grade, certainly no later than the seventh, certain elements of generalized arithmetic should be introduced and should be carried along with the arithmetic until the pupils become familiar with literal notation and the equation. This work is not properly called algebra as the number field would not necessarily be extended to include negative as well as positive numbers. This form of literal arithmetic presents all that is practical of algebra for ordinary purposes. So much of it is decidedly of utilitarian value since the mechanics of to-day who wish to read trade journals need to be familiar with it. This form of literal arithmetic has in its favor most if not all that can be said for algebra as an eighth-grade subject.

It seems probable at the present time that these two tendencies will become more pronounced, i. e., there is almost certain to be more dissatisfaction with the extreme form of algebra brought down from the high school, and as teachers are trained for the work, there is to be, it is hoped, greater interest in the form of generalized arithmetic outlined.

GEOMETRY IN THE GRADES.

The mensuration of certain geometric figures has always been included in American arithmetics. In recent years, as has been said, there has been a decrease in the extent of this work. It was formerly the practice to have this work consist mainly of definitions, formulas, and problems. This has been changed by giving experimental and intuitive verifications of the formulas. It has been uncommon to have any other form of geometry, except in isolated places where some form of constructional, inventional, or concrete geometry has been introduced. The motive has been to teach certain elementary ideas of geometric forms, to train the hand in the use of customary drawing tools, to train the eye in its judgment of geometric forms and relations, and to train the mind in such general functions as observation and generalization as pertaining to geometric data. This work has been attempted usually under the guidance of a pamphlet prepared for some specific school by those interested in such work.

The movement has not spread much. Possibly one reason for the slowness of the introduction of this work has been the custom of including in the art course usually given in American schools some "mechanical" drawing—constructions with the straightedge and compasses. This custom has been unfortunate, at least from the mathematical standpoint, as, in the drawing course, the emphasis has been upon the results; the possible cultivation of desirable habits of geometric study, and the possible training of the powers of observation and generalization have been largely neglected. A further reason for the lack of such is the scarcity of teachers acquainted with and prepared to teach geometry inductively. The majority have studied geometry only in the Euclidean form.

EXAMINATIONS.

Examinations given in the schools are of three kinds: (*a*) Those given by the teachers themselves; (*b*) those given by the supervisory officers of the schools; (*c*) those given by a school to determine the qualifications of pupils who wish to enter the school.

The examinations given by the teachers are of two kinds: The ordinary written recitation and the stated examinations which may be required by the school regulations. The first should not be called examinations in one sense of the word, since they cover usually only a short interval of previous instruction and are given as a means of affording the same sort of drill for all of the class or as a means of detecting weaknesses as a basis for further teaching. Such written lessons are left entirely to the teacher, although it is advised that they be given frequently. Such "examinations" are in every respect desirable.

The other form of examination given by teachers is more formidable. Most school systems provide that the standing of a pupil in a class shall be determined in part by examinations given at stated times. The examinations may occur monthly, quarterly, semiannually, or annually. They count from one-half down in determining a pupil's standing. When the questions are prepared by the teacher, the questions and the papers are at the disposal of the principal or other supervisors. The teacher has an opportunity to adapt the examination to the capabilities of the class, and can allow for the individuality of the pupils. Under this plan a sympathetic influence is likely to pervade the examination. As a means of administration this form of examination depends for its success upon the teachers and the opportunity of inspection. As an educational practice it is to be commended as compared with those examinations which are not prepared with the same sympathetic recognition of the pupils' interests, which the teachers are likely to display.

As a rule uniform tests are given in most school systems for administrative purposes. The questions are prepared either by the superintendent or by a committee of principals or teachers—usually principals—working under the direction of the superintendent. In few cases do the teachers have any choice concerning the questions which they submit to their classes. The teachers grade the papers and then submit them to the principals. These examinations are given to set standards of work, to interpret the course of study, to promote uniformity throughout the system, to bring out the weak points in the teaching, and to point out conditions in the school. In some cases it is urged that these examinations train the pupils to prepare their thoughts on a subject in good order in a limited time. In general the interests of the pupils are served only indirectly by these examinations as the emphasis is upon the administrative advantages. The results are sometimes used in determining a pupil's fitness for promotion, although it is seldom that failure in these examinations is allowed to retard a pupil's progress.

These examinations are an effective administrative device. Their success depends upon the experience, the wisdom, and the ideals of the supervisory staff. As a rule, these examinations do not meet with favor among the teachers. There is a feeling that the test is one of themselves rather than of their pupils. From what has been said this appears to be true, although it depends upon the purposes of the supervisors. The better teachers recognize the advantages to be gained, and, having the proper professional spirit, they are willing to have their work compared with that of their colleagues in other schools. The examinations are opposed also because of their effect upon the pupils. It is contended that the pupils are subjected to a severe nervous strain so that they do not do themselves or their teachers justice. This is possibly true. The evil results, however, may be minimized under wise supervision. If the teachers adequately prepare the pupils for the tests by reviews, and if the tests are adapted to the possible ability of the pupils, the evil results mentioned are not necessary. In the larger cities the difficulty of conducting these examinations is great, owing to the wide diversity in the population in various parts of the city. Another objection raised to such examinations is that thereby the teachers are hampered in their work, with the result that there is little progress from year to year. This again may or may not be true, dependent upon the supervision. As a rule, the supervisors of the schools will see that the tests promote rather than retard progress.

Another form of examination proposed at the present time is that designated as the "standardized" test. For a complete discussion of the nature of these tests, see the report by Dr. C. W. Stone, in the report of subcommittee No. 2 of this general committee. As to current practice, it is safe to say that little work of this nature is done in the schools. As to tendencies, there is little evidence upon which to base a statement one way or another. It would seem well for those in charge of the general tests just discussed to introduce into them such of the elements of these standardized tests as seem applicable to their needs and purposes.

In the eighth grade tests are sometimes given to determine the fitness of pupils for promotion to high school. This is not a common practice, however.

METHODS OF INSTRUCTION.

It is possible to speak only in a general way of methods of instruction as these vary with schools and with teachers. Much that can be said on this topic for the two upper grades would apply equally well for the other grades.

CLASS INSTRUCTION.

In all of the schools instruction is given to groups of pupils varying in number from 5 to 30 or more—groups called classes. The average size of classes is probably in the neighborhood of 20 and a strong effort is being made in all cities to cut down larger classes to this number. This form of instruction is called class instruction. There have been numerous attempts to modify this form of instruction by various forms of individual instruction in order to meet in a better way the needs of weak pupils. In some schools special teachers are employed to take charge of any pupils from any class who are backward in their work. As a rule, however, the regular class teacher does this herself either before or after regular school hours. An effort is made of course to organize the classes so that all pupils in the class will have as uniform ability as possible.

RECITATION AND STUDY TIME.

In most schools the arithmetic class meets daily for from 20 to 30 minutes. This time is known as recitation time. Besides this the pupils of the class usually have in school another period of equal length for the study of arithmetic. This makes the total time for arithmetic vary from 200 to 300 minutes per week. In most schools the children do no studying on arithmetic at home; in the upper grades they probably do, although the tendency to-day is to relieve pupils of any home preparation in mathematics in the elementary schools. Each pupil possesses a book. This book is not merely a collection of problems; it is usually a text providing the necessary theory and such explanation as seemed wise to the author. From the terminology used to denote the two periods, it is obvious that at some time the pupils were expected to prepare themselves in the " study " period on certain assignments in the text upon which they later recited in the " recitation " period. This was especially true in the upper grades, and unfortunately is probably true in many classrooms to-day. In the majority of schools this condition has undoubtedly changed; the recitation period should properly be called the " teaching " period and the study period might better be called the " work " period. The class time was formerly given over often to indiscriminate recitation on the solutions which the pupils had performed outside of class; it is now given over either to carefully planned drill or to instruction by the teacher on some new topic. The study time is used to supplement the class time.

DIVISION OF THE CLASS TIME.

One of the characteristic features of the teaching period is the mental work. It is common practice to direct the teachers to devote from one-third to one-half of the class time to oral-mental work. It is oral in the sense that the teacher gives the directions orally; it is mental in the sense that the pupils perform the necessary computations without use of pencil and paper. The responses of the pupils are given either orally or in writing. This work is designed either to maintain efficiency through wise drilling on topics previously taught or to lead up to and teach some new topic. This must be considered a feature of current teaching method, since formerly much of the class time was given over to "recitation" by the pupils on work which they placed upon the blackboard.

There are occasions when it is worth while to have the whole class solve problems in writing; this is especially true in the upper grades where the conditions of the problems become more confusing. As a rule, however, written work is done outside of class. In the past pupils have been required to present more or less elaborate analyses of the solutions for their problems. The desire was to have the pupil set forth in detail the process of thinking by which the solution was accomplished. The advantage of such solutions to the teacher is obvious; it is an equally obvious fact that such formality is entirely foreign to the natural, rational mode of presentation which an adult would use in ordinary life. Such a requirement is subject to criticism also because it confuses the pupils. The tendency now is to ask the pupils to give a clear presentation in good form; in the upper grades, they are encouraged to use any "short cuts" of which they know, and to do mentally as much of the computation as they can. Another reform which has been accomplished is the discontinuance of elaborate forms of ruling on the papers, a practice which has been altogether too prevalent in the past.

RAPIDITY AND ACCURACY.

The teachers of the upper two grades seek to develop in their pupils skill in computing which will enable them to perform ordinary calculations with rapidity and accuracy. In the lower grades the pupils are taught the processes and the number facts; in the upper grades the emphasis is properly turned in this other direction.

The mental work has this as its aim. The pupils are frequently given problems to solve in a limited amount of time; they are encouraged to compete with one another by being invited to rise when they have solved the problems; they are given honorable notice in various ways for achievement in these respects.

CONCRETE METHODS.

On account of the influences mentioned in former paragraphs, the teachers endeavor to make the instruction as concrete as they can without going to the extreme of objectifying relations which are obvious. Thus in the discussion of commercial forms, actual samples are exhibited; checks of some real or imaginary bank are drawn in class; account books are kept by the pupils and are balanced monthly, each child filling in records of real transactions when possible; interest-bearing and noninterest-bearing notes are shown; banks are visited or conducted in the schoolroom; the class resolves itself into a stockbroker's office, one member acting as the broker and the remaining members of the class acting as buyers or sellers of stocks or bonds. In mensuration, actual measurements are used when possible; problems are sought in the manual training department; formulas are obtained by experimental methods instead of being taken on faith and then used. The teachers endeavor to give to their classes clear impressions of a few things rather than superficial word knowledge of many things.

DEPARTMENTAL TEACHING.

One especially characteristic feature of the seventh and eighth grade work is the practice of having the mathematics, and some of the other subjects, taught by teachers who as a rule teach no other subjects. In the lower grades this is not common. This is known as departmental instruction. It is quite common in the larger school systems and is being extended as rapidly as circumstances permit. The teachers in charge of the departmental work are usually the more experienced teachers of the system and as a rule have had special training for their work. In many cases college graduates are obtained for these positions, whereas usually the teachers in the elementary schools do not have collegiate training.

Departmental instruction is favored because of the obvious advantage of having for this upper grade work teachers who are specially interested in and qualified to teach their subject. Departmental instruction has the disadvantage of placing the training of young children in the hands of each of several teachers, working independently, with the result that often the emphasis is placed upon teaching the subject rather than upon the education of the child. This difficulty is obviated by wise supervision, under which there will be cooperation between the various departmental teachers in any one school.

INDUCTION AND DEDUCTION.

It is very likely that no conscious thought is given to these two types of teaching methods by the majority of teachers. At the same time it may be said that the instruction is either by inductive methods or by rule followed by practice. The habit of proceeding from "the known to the unknown," from "the simple to the complex," is so characteristic of the teachers that they approach new topics whenever it is possible by inductive means. For example, the nature and the meaning of "paying interest" for the use of money may be approached through the acquaintance the pupils have with the practice of paying "rent" for the use of a house; the nature and meaning of shares of stock may be approached through the pupils' experience in contributing their share toward the expense of a picnic. On the other hand, when it comes to a process such as finding the square root of a number, the books as a rule develop the process in the usual way with the aid of the formula for the square of a binomial; but the teachers are commonly advised to simply illustrate the process and then fix it in the minds of the pupils by adequate drill.

THE PAROCHIAL SCHOOLS.

This investigation covers the field embraced by Roman Catholic parochial schools, which number in the United States 4,845, having a total registration of 1,237,250 pupils. These schools outnumber other schools maintained by any single church organization, and for this reason they are selected for this investigation. In general they do not charge any tuition, unless to pupils not residents of the parish. They are in most cases supported by the Roman Catholic Church from a fund voluntarily contributed by members of the church. In many instances, however, where such a fund does not exist tuition is charged at 50 cents a month for the lower grades and $1 a month or more in the higher grades.

The committee finds none of them to be endowed in any way or to receive any State or municipal support.

The Roman Catholic Church divides the United States into 70 dioceses, in each of which a board of supervisors has charge of the educational work in the parish schools. It is the business of the diocesan board to make out the course of study for the various schools, select the books to be used, and to pass on any matters pertaining to the work of the schools.

The teachers, being generally members of religious orders, are appointed by the superior of the order to which they belong, as recommended by a committee acquainted with the attainments of the candidates. The different religious orders have a community inspector of schools who reports to the superior on the efficiency of the teaching staff. The following syllabus of mathematics as taught in the seventh and eighth grades is selected as representative of the better class of schools and is from the Philadelphia diocese.

ARITHMETIC—SEVENTH GRADE.

(1) Drill exercises for accuracy and speed. (2) Miscellaneous problems involving fractions. (3) Multiplication, division, and miscellaneous problems on decimals. (4) Denominate amounts: (*a*) Measurements, extending to circle and cylinder; (*b*) compound amounts in use; (*c*) longitude and time. (5) Percentage: (*a*) Review and extension of sixth year's work; (*b*) bank discount. (6) Ratio and proportion: (*a*) Ratio; (*b*) simple proportion; (*c*) proportional parts.

ARITHMETIC—EIGHTH GRADE.

(1) Common and decimal fractions; underlying principles considered and applied. (2) Denominate amounts. (3) Percentage: (*a*) Review and extension

of seventh year work; (*b*) stocks and bonds; (*c*) compound interest; (*d*) drafts and exchange; (*e*) partial payments. (4) Proportion and partnership. (5) Powers, roots, and mensuration. (6) Review of practical measurements: (*a*) Plane surfaces; (*b*) triangles, quadrilaterals, regular pyramids, right cylinders, right cones, frustums of regular pyramids, and cones, spheres; (*c*) similar figures.

ALGEBRA—SEVENTH GRADE.

(1) Explanation of algebraic terms to be employed and illustrations of their uses. (2) Literal expressions; their numerical value obtained. (3) Comparison of arithmetical and algebraic solutions of simple problems, and solution by algebra of many such problems. (4) Positive and negative quantities explained and practical problems employing their uses considered. (5) Addition and subtraction. (6) Parentheses. (7) Multiplication and division.

ALGEBRA—EIGHTH GRADE.

(1) Review of addition, parentheses, multiplication, and division. (2) Composition and factoring. (3) Highest common divisor and lowest common multiple. (4) Fractions. (5) Simple equations.

The average age of pupils entering the seventh grade is between 12 and 13 years, and at leaving the eighth grade about 14 years. In about half the schools reporting, promotion from grade to grade is determined by the teacher. In the remaining schools promotions are recommended by the teacher and determined by the principal. All schools average the class work and examination in determining promotion, usually each counting 50 per cent, but a few giving two-thirds credit for class work. In the case of seventh and eighth grade examinations, some schools give the questions as made out by the city superintendent of public schools, and papers are marked by public school authorities for eighth-grade examinations. Where Catholic high schools exist the principal and teachers make out the questions, while the examination is conducted by the teacher and the papers are inspected by higher authorities. About one-fourth of the schools permit of a choice of ten questions out of eleven, the others allowing no choice.

Regarding promotion after failure to pass in a mathematical subject, a wide diversity of practice exists. The question asked in this respect was, "To what extent does failure in a mathematical subject retard a pupil's progress?" Some answers received were as follows: "As a rule, a mark below 60 per cent in any mathematical class requires a repetition of the class"; "Considerable deficiency influences a pupil's promotion"; "Not kept longer than two years in a class"; "Mathematics is one of three studies on which promotion is based"; "Conditional promotion is given, but is withdrawn if progress is not made"; "Must cover program again"; "Must stay in class"; "Those notably deficient are not promoted"; "Debars pupil from promotion"; "Passes to next year's grade if only failure is in mathematics."

Promotions are made annually or semiannually about equally. In regard to the object influencing the teaching of mathematics, preparation for high school stands first, the demands of the business world second, and about 20 per cent report discipline and culture as the predominating influence.

Oral work in class, which is given in all schools, varies in extent from 12 minutes to half the recitation period daily, and nearly all schools report a preliminary discussion of newly assigned topics until a sufficient knowledge to proceed has been obtained.

The size of class varies in different localities from 10 to 65, the average class for the seventh grade being 34, and for eighth grade, 27. The usual time spent in recitation per week is 200 minutes with 150 minutes per week given to study in school. There is also some home work given that requires about 30 minutes nightly.

In the eighth grade, the time given to recitation and study are about as shown for seventh grade, and some algebra is often introduced.

Reforms contemplated are, "more oral work," "to apply the work to problems of personal interest to the pupil," "to eliminate the nonessentials and emphasize the essentials," "better work in oral arithmetic," "more drills for thoroughness."

SUBCOMMITTEE 6. PREPARATION OF TEACHERS FOR GRADES 7 AND 8.

In preparing this report the committee attempted to obtain information from both public and private elementary schools in accordance with plan suggested by the American commissioners. Practically no response was received from private schools to which blanks were sent, and hence the report is limited to public elementary schools.

I. PRESENT STATE OF ORGANIZATION.

TEACHERS.

In investigating the present state of organization, the tabulation of elementary schools given by the United States Commissioner of Education in his report for 1908, volume 2, pages 502–517; 596–611, was used. In these tables are listed 531 schools in cities of over 8,000 population, and 670 schools in cities of 4,000 to 8,000 population. The first group is known in the report as Class A and the second as Class B.

Five hundred cities, 250 from each class, were selected for the purposes of the report, each member of the committee selecting 100 from the section assigned to him, 50 from each class. Only graded schools were chosen, and each State was considered in proportion to the number of its school systems.

In response to a questionnaire sent to the 500 cities, 238 replies were received as follows:

NUMBER OF CITIES REPORTING.

	Class A.	Class B.
North Atlantic	29	19
South Atlantic	13	11
South Central	13	11
North Central	64	54
Western	13	11

The following tables summarize the information received from the cities:

TABLE 1.—*Teachers.*

	Number in seventh and eighth grades.				Preference of cities as to sex of teachers for seventh and eighth grades.					
	A		B		A			B		
	Men.	Women.	Men.	Women.	Men.	Women.	No preference.	Men.	Women.	No preference.
North Atlantic	679	2,642	11	121	11	3	6	7	6	3
South Atlantic	41	164	16	37	5	3	1	5	3	....
South Central	40	155	10	36	9	1	2	5	4	....
North Central	192	1,602	55	294	28	17	9	31	7	8
Western	35	354	20	69	8	1	1	5	1	1
Total	987	4,917	112	559	61	25	19	53	21	12

TABLE 2.—*Prepcration of present teaching force in grades 7 and 8.*

	Actual.			Preference by cities.		
	College.	Normal.	High school.	College.	Normal.	High school.
North Atlantic:						
A	895	316	953	13	15	....
B	9	90	126	3	16	....
South Atlantic:						
A	48	41	110	11	7	....
B	18	19	41	1	9	....
South Central:						
A	62	52	139	8	3	2
B	19	9	31	4	6	2
North Central:						
A	115	953	1,727	21	38	....
B	50	111	311	19	31	1
Western:						
A	13	121	127	5	7	....
B	21	52	55	4	4	2
Combined:						
A	1,133	1,483	3,066	58	70	2
B	117	281	564	31	66	5
Total	1,250	1,764	3,620	89	136	7

TABLE 3.—*Present requirements of cities as to preparation for teachers of grades 7 and 8.*

	Academic.				Professional training.				Certificate.					
	College.	Normal.	High school.	None.	Two years.	One year.	Experience.	None.	State.	First grade.	Second grade.	City.	None.	Normal school diploma.
North Atlantic:														
A	3	12	11	5	15	1	7	4	5	....	1	5	14	2
B	....	5	8	4	10	....	3	5	4	....	....	....	10	2
South Atlantic:														
A	2	5	4	4	3	....	3	6	....	7	....	2	1	2
B	....	5	2	....	2	....	4	....	1	6	....	....	....	1
South Central:														
A	2	4	5	1	5	1	....	5	4	2	1	4	1	1
B	3	2	3	2	1	....	3	4	1	3	2	1	2	......
North Central:														
A	3	16	39	11	27	5	14	13	4	21	13	13	7	12
B	1	11	22	16	18	6	12	13	6	18	14	2	6	10
Western:														
A	....	4	9	....	10	....	1	....	1	3	6	....	2	......
B	1	3	4	....	7	....	1	2	2	2	4	....	1	......
Combined:														
A	10	41	68	21	60	7	25	28	14	33	21	24	25	17
B	5	26	39	22	38	6	23	24	14	29	20	3	19	13
Total	15	67	107	43	98	13	48	52	28	62	41	27	44	30

In New York City the preparation required of men teachers in grades seven and eight is: (1) College course and one to three years' experience; or (2) a normal school course and three years' experience. In addition there is required a promotion license based on, (1) three years' experience; (2) 60 hours' professional course; (3) examination in arithmetic, algebra, and geometry. For women teachers the requirement is (1) normal school course and one years' experience; (2) New York State life certificate and five years' experience; or (3) college course and one years' experience.

In two cities of Class A and three of Class B, men are preferred for the eighth grade and women for the seventh. In New York City men are preferred for teaching boys and women for teaching girls. In Auburn, N. Y., and seven other places reporting, the preference is for an equal division of men and women teachers in the grades in question. There is a general opinion that on the present salary basis women teachers are preferable to the men who are willing to work at present rates of compensation.

COURSE OF STUDY.

The course of study in mathematics for the seventh and eighth grades of the public schools throughout the United States is remarkable for uniformity. In the seventh grade the usual topics are denominate numbers and percentage; in the eighth grade, applications of percentage—discount, insurance, notes, stocks and bonds, etc. These topics are supplemented by review or advance work as time allows. For example, in a typical school we find in the seventh grade in addition to the topics named above, analysis of problems, ratio, fractions, decimals; in the eighth grade, proportion, powers and roots, longitude and time.

The excellent course of study in mathematics for the public schools of Augusta, Me., says: " Up to this time (seventh grade) the pupil has been, to a large extent, a mere reckoner; he should now become something of an arithmetician. The mathematical mind was a late development in the race, and its growth in the child should not be forced. It is believed, however, that this grade marks the approach of the time when the pupil should pass from mere control and manipulation to understanding and investigation. He may now be asked to define arithmetic, or at least attempt a definition, and should appreciate some of the difficulties of its development.

" No discrimination need be made between algebra and arithmetic, nor between algebraic and arithmetical solutions. Pupils should not feel abashed in the presence of x, but should regard it as a good friend, employ it habitually, and if possible, unconsciously, to represent unknown quantities, and solve the equations containing it entirely as a matter of course."—Course of study in mathematics for the elementary schools, Augusta, Me., 1909

In this connection it is interesting to note that of the 238 cities reporting to the committee 11 of Class A and 7 of Class B teach algebra in the seventh grade, while 47 of Class A and 26 of Class B teach it in the eighth grade. Concrete geometry is taught in the seventh grade of 8 Class A schools and of 3 Class B schools; it is taught in the eighth grade of 10 Class A schools and of 8 Class B schools.

In New York City the consensus of opinion of the large majority of principals is that the inventional geometry and algebra of the seventh and eighth grades should be entirely omitted; that these subjects should be relegated to the high school, and that the time gained should be given to pure arithmetic.

In Chicago the board of education has recently voted to drop algebra and geometry from the seventh and eighth grade courses.

A very few schools reported such unusual features as the correlation of arithmetic, algebra, and geometry, and the segregation of pupils. The department plan is used by 103 schools.

In Class A 99 schools reported the present course satisfactory, while 30 reported the opposite. In Class B 58 schools reported course satisfactory and 39 reported unsatisfactory. As causes of dissatisfaction 83 gave " poor teachers "; 49, " course of study "; 12, " large classes "; 10, " lack of time "; 13, " poor pupils "; 12, " textbooks."

In response to a question relative to the attempts to " humanize mathematics," 68 report " good "; 30, " none "; 27, " doubtful." The effect of manual training is considered " good " by 104. " none " by 9, and " doubtful " by 35.

Among recent improvements, 28 report "none"; 64, "course of study"; 51, "teachers"; 32, "texts"; 3, "salaries"; 9, "department teaching."

II. THE TRAINING OF SEVENTH AND EIGHTH GRADE TEACHERS OF MATHEMATICS.

1. CITY TRAINING SCHOOLS.

Of 132 Class A cities included in this investigation, 29 report city training schools with an attendance of 127 men and 3,222 women. Of this number, 113 men and 2,182 women are reported from the three New York City training schools.

The plan of organization varies from the St. Louis five-year course for high-school graduates to that of a department of the high school. Local conditions govern in this matter. Theory and practice are about evenly balanced in all cases. Academic instruction varies from the first two years of a university course, as in Cincinnati, to none at all in 11 schools reporting.

Fifteen of these training schools give opportunity for practice teaching of mathematics in grades 7 and 8. The longest practice period reported is that of Cambridge, Mass. In that school one year of practice teaching is offered and cadet teachers are paid $200 to $250 per year.

Seven city training schools offer courses in the history and teaching of mathematics; one mentions as a special feature a mathematical library.

In response to a question as to the conditions which a rational preparation of teachers for the grades in question should fulfill, replies were received as follows: Massachusetts—(*a*) normal or college diploma, (*b*) summer school course at least every third year, (*c*) membership in local mathematics club, (*d*) membership in New England Mathematical Association; Virginia—(*a*) high-school course, (*b*) good normal course, with practice work; Georgia—(*a*) teaching knowledge of subject, (*b*) practice course, (*c*) rational course in pedagogy; Indiana—inexperienced teachers should not be allowed in seventh or eighth grade work; Iowa—good knowledge of arithmetic, algebra, and geometry; Missouri—more attention to subject matter, but method not neglected. The remaining 23 cities offer no suggestions on the question.

2. UNIVERSITY AND COLLEGE DEPARTMENTS OF EDUCATION.

Sixty university and college departments of education reported as follows: North Atlantic, 7; South Atlantic, 10; South Central, 6; North Central, 32; Western, 5.

Twenty of these schools offer opportunity for general practice teaching in mathematics and 15 give practice in grades 7 and 8 of their training school. Twenty-two offer course in the teaching of mathematics and 16 in the history of the subject. Research work is done in 13 schools. In the rational preparation of teachers, 35 believe that emphasis should be laid upon subject matter, while 21 would stress method.

In all of these schools students preparing to teach have access to the regular college and university courses in mathematics.

3. STATE NORMAL SCHOOLS.

Reports were received from 88 State normal schools, as follows: North Atlantic, 17; South Atlantic, 5; South Central, 8; North Central, 36; Western, 14.

Seventy of these schools require general practice teaching in mathematics, while 66 require it in grades 7 and 8 of their training schools. Courses in the teaching of mathematics are offered by 52, and courses in the history of mathematics by 14 schools, while 5 give opportunity for research work.

The mathematics course in normal schools varies greatly. The minimum is a high-school course. About one-fourth offer college courses in mathematics. Nearly all of this group are in the North Central and Western States.

4. PRIVATE NORMAL SCHOOLS.

Forty-two private normal schools sent in reports. They were distributed as follows: North Atlantic, 3; South Atlantic, 19; South Central, 8; North Central, 11; Western, 1.

Of this number 28 have practice schools, and 24 give special training in teaching seventh and eighth grade mathematics.

Courses in the teaching of mathematics are offered by 20; in the history of the subject by 4. Two of them give opportunity for research.

In connection with both public and private normal schools, it is a matter of special interest that, contrary to the usual opinion, the majority lay emphasis upon subject matter of mathematics in teacher preparation rather than upon method. Sixty-one would emphasize subject matter, while 22 would lay the emphasis upon method.

5. THE FORWARD MOVEMENT IN NEW YORK.

(*a*) In New York City in April 1911, the board of education took action requiring all teachers not holders of a grade "A" license to pass an examination before promotion to positions in seventh and eight grades. For the improvement of the teaching of mathematics in grades 7 and 8 the following steps have been taken:

1. Special attention to the subject by many of the district superintendents in principals' conferences and in holding tests for different grades uniform throughout their respective districts.
2. The issuance of an important special circular by the city superintendent indicating the main errors committed in teaching mathematics in the city schools and pointing the way to remedy those errors.

3. The establishment of courses of instruction in the history of mathematics and in methods of teaching elementary mathematics. Some of these courses have been given under the independent auspices of teachers' associations, others have been given in cooperation with local universities, and others have been given independently by local universities.

4. The local teachers' and principals' associations of the Borough of Brooklyn have jointly prepared a carefully devised general teaching plan in mathematics for the purpose of securing desirable uniformity in the sequence of topics in the schools of the borough. This plan is widely used.

(*b*) In New York State revisions of the graded-school course are in progress, which will very materially affect the work of the next five years. The following extract from the 1910 report of Commissioner Draper indicates the nature of the revisions:

> A syllabus covering the first six grades is submitted. * * * It has not been possible nor was it expected that all of the present work of the seventh and eighth grades could be put in the six years' course. * * * The intermediate course covering such grades to round out the elementary course has been prepared. It is in this two years' (seventh and eighth years) course that the elementary work will begin to differentiate. The regular course will lead to the present high-school course. It includes arithmetic, history, English, physiology, modern languages, and other subjects which have previously been considered in academic work. * * * This two years' course also includes work specially adapted to prepare pupils for commercial and industrial courses in high schools and in trade schools.

6. GENERAL OPINIONS CONCERNING THE RATIONAL PREPARATION OF TEACHERS FOR GRADES 7 AND 8.

Some of the general opinions concerning rational preparation of teachers are noted here. They are fairly representative of the whole group.

From a Pennsylvania normal school:

> A more complete appreciation of the subject matter, emphasizing its philosophy and the need of absolute accuracy of statement and of result. In addition to this must come an appreciation of the mental activity to which the various phases of the mathematics make their appeal, why this is so, and the means of making this appeal most effectively—this I think of as the pedagogy of mathematics.

From Commissioner Draper's 1910 (New York State) report:

> The normal schools are charged with the special duty of training teachers for the elementary schools. * * * The elementary work of the seventh and eighth grades is to be so radically changed under the new syllabus that special provision must be made for training teachers for these grades so that more men will enter this field of teaching.

From a New York State normal school:

> (1) It (rational preparation) should give a thorough knowledge of the subject matter of arithmetic; (2) it should emphasize the development of the

subject from the beginning, and the methods of teaching the subject; (3) it should include a discussion of modern movements and modern tendencies, and the consideration of the different classes of material with which the teacher should be provided. * * * The average normal pupil's knowledge of algebra is too limited to enable him to follow any discussion of methods of developing topics in algebra.

A new Jersey State normal school:

Students who come to us from high schools which give the best preparation in mathematics are the best students in methods of teaching arithmetic. Therefore a round course of mathematics before methods of teaching.

Southwest Texas Normal School:

When the entrance requirements are low, nearly if not all the time should be given to the acquisition of subject matter. As entrance requirements are raised, more time should be given to the professional work of the subject.

University of Texas School of Education:

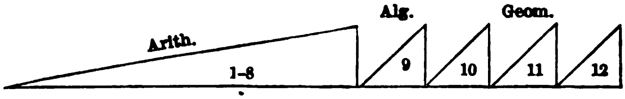
The training of teachers of mathematics for grades 7 and 8 should include these features: (*a*) Scholarship, including solid geometry, trigonometry, advanced algebra, and some analytics; (*b*) a course in general method; (*c*) a course in psychology, including developmental psychology; (*d*) a course in the history of education; (*e*) a course in practice teaching.

Washington State Normal School:

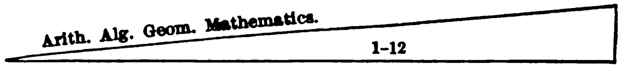
I am inclined to think that more attention should be given to subject matter, but not any less to the method. We have so many "isms" that mathematics is not receiving its just share of time. Most students coming from accredited high schools are weak in the subject matter of arithmetic.

Washington State University department of education:

The great weaknesses of mathematics in the grammar grades are two: (1) The absurd American plan of grinding out complex and almost impossible arithmetic before taking up enlightening and comparatively simple elements of algebra and (plane?) geometry. This is an intolerable fault. Our actual curve of difficulty is this—



when it should be of course—



(2) Mathematics should be more concrete in the grammar school (and I think even in the high school), and (*a*) more clearly related to the boy's interest, (*b*) more closely correlated with other subjects.

Montana State Normal College:

We find that it is very difficult in the time we have here to make students satisfactorily reliable in arithmetical subject matter. High-school graduates seem to have lost completely all the knowledge of arithmetic presumed to have been acquired below the high school, except the little which they use in higher mathematical subjects, and even in that little they are rarely accurate.

Iowa State Teachers' College, President H. H. Seerley:

> Mathematics has a proper place from the fourth grade through the twelfth grade, provided it is adapted to the age and development of the pupil. All the arithmetic necessary to be known can be taught in less than a year if given at the proper time of the pupil's development. There is a great waste of time now, as children are treated as if they need adult knowledge. A suitable book on mathematics should be written for the grades below the high school.

CONCLUSION.

The committee has attempted to set forth the present conditions relative to the preparation of teachers of mathematics for grades 7 and 8 of the public elementary schools of the United States. No effort has been made to draw conclusion or to formulate a program for the future.

It is very evident that in proportion to the need there is but little specific preparation for the teaching of seventh and eighth grade mathematics. There is a failure to realize the truth of the statement previously noted that "this (seventh) grade marks the approach of the time when the pupil should pass from mere control and manipulation to understanding and investigation," and to provide the kind of instruction needed to lead the pupil out into the broader field of mathematical knowledge.

The failure of the school authorities to grasp the real meaning of algebra and concrete geometry in the seventh and eighth grades is characteristic of the attitude of the American people toward the public schools. The fear that formal algebra and formal geometry are going to crowd out some more practical subjects is what lies back of such action as that in Chicago. If the necessary general arithmetic and concrete geometry could have been made part of the arithmetic course with no comment upon the relation to the more formal courses of the secondary school, and no introduction of the names by which the later courses are known, possibly the progress toward a more efficient course of study might have been greatly hastened. Only 38 per cent of the cities report any algebra (general arithmetic) in grades 7 and 8 and only 12 per cent report any concrete geometry.

We need in the seventh and eighth grades teachers who have been led to see mathematics as a part of human progress, and who can open the eyes of their pupils to behold the same vision. In the words of President Butler:[1]

> Mathematics, therefore, studies an aspect of all knowing, and reveals to us the universe as it presents itself, in one form, to mind. To apprehend this, and to be conversant with the higher developments of mathematical reasoning are to have at hand the means of vitalizing all teaching of elementary mathematics.

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[1] Introduction to Smith's The Teaching of Elementary Mathematics, p. xi.

COMMITTEE NO. II. SPECIAL KINDS OF ELEMENTARY SCHOOLS.

GENERAL REPORT.

The investigations of the committee on the teaching of mathematics in special kinds of elementary schools have been confined to a discussion of the work as it is given in trade and industrial schools. There are other special types of schools, notably those that deal with defectives and delinquents that might be considered under this classification. It seemed best to the committee, however, to confine their attention to the group mentioned above. The work done in the schools for defectives is a modification of that commonly done in other schools by means of methods of instruction suitable to the type of mind dealt with. In schools for delinquents, whether day truant schools, parental schools, or reformatories, the work is quite commonly either the ordinary work in mathematics given in elementary or secondary schools, or such as is considered in that part of this report relating to industrial schools.

In the Bulletin No. 11 of the National Society for the Promotion of Industrial Education there is given a descriptive list of trade and industrial schools in the United States. This bulletin was issued in August, 1910. There were at that time more than 140 such schools about which the society was able to gain information. The classification of these schools is as follows:

1. Intermediate industrial, preparatory trade, or vocational schools.
2. Trade schools: Day courses—(*a*) supported by public funds; (*b*) supported by private funds.
3. Technical schools: Day courses—(*a*) supported by public funds; (*b*) supported by private funds.
4. Apprenticeship schools.
5. Evening schools: (*a*) Giving technical courses and supported by public funds; (*b*) giving technical courses and on private foundation; (*c*) courses given by Young Men's Christian Associations; (*d*) giving practical shop courses and supported by public funds; (*e*) giving practical shop courses and on private foundation.
6. Part-time schools.

7. Trade schools for colored races.
8. Correspondence schools.

All of these different classes of schools can be considered as special kinds of elementary schools as contrasted with the ordinary high school. From another point of view they are secondary schools, since in most cases at least six years of elementary school work is required for entrance, and since the courses of instruction offered lead directly to vocational efficiency. The committee has concerned itself with all of these groups of schools in its report even though they may not have been specified in the outline of work proposed, and may not be specifically mentioned in the later discussion.

Some brief statements of the work of these several classes of schools may not be out of place as a preliminary to the consideration of their work in mathematics. In the statements which follow, the characterization of the catalogue of the National Society for the Promotion of Industrial Education mentioned above is followed, and in some cases the exact wording is quoted.

INTERMEDIATE INDUSTRIAL, PREPARATORY TRADE, OR VOCATIONAL SCHOOLS.

These schools take pupils who are 14 years of age and have completed at least six years of the elementary school course. These children are too young to be accepted as apprentices in the trades, and yet have commonly left school to enter upon occupations which promise very little advancement even after several years of service. "The intermediate industrial school has the double aim of turning the attention of its pupils, and of the parents of pupils, to the superior opportunities for independence offered by work in the manual trades, and of giving them such instruction as will enable them after two or three years to enter the trades with advantage. By this means it is designed to retain for a longer period of time the boys and girls who otherwise leave school."

"In schools of this class, the course of study commonly combines bookwork and shopwork in almost equal proportions. The bookwork generally includes English, shop mathematics, industrial history, and civics, together with the elements of physics and chemistry. The shopwork is usuall confined to a limited choice of preparatory trade work for each sex. Beginning with general industrial practice the work is more specialized toward the end of the course and carries the pupil to a point at which he will be able to enter a skilled trade or a factory industry as an apprentice possessing a general knowledge of the quantities involved and a background of scientific knowledge that will open the way for comparatively rapid promotion." Examples of schools of this type are the following: Secondary Industrial School of Columbus, Ga.; New Bedford Industrial School, New Bedford, Mass.; Lawrence Industrial School, Lawrence, Mass.; Newton Independent Industrial School, Newton, Mass.; Albany Vocational School, Albany, N. Y.; Hudson Industrial School, Hudson, N. Y.; New York City Vocational School for Boys, One hundred and thirty-eighth Street and Fifth Avenue; Rochester Factory School, Rochester, N. Y.; Rochester Shop School, No. 26, Rochester, N. Y.; Industrial School, Schenectady, N. Y.

TRADE SCHOOLS.

Trade schools which offer day courses are of two distinct types. Some have very short courses like the Baron de Hirsch Trade School, and the New York Trade School, where very little attention is given to instruction in English, mathematics, or science. In these schools the aim is to prepare pupils for actual work in the trades in the shortest possible time. After a course of from four to six months the student can frequently secure employment as a helper, and, because of the work done in school and his knowledge of the theory of the trade, he can commonly advance rapidly to the grade of journeyman. The trade schools giving longer courses frequently give very thorough instructions in English, mathematics, and science. The Williamson Free School of Trades and the Wilmerding School of Industrial Arts devote a considerable proportion of time to such instruction.

The Manhattan Trade School for Girls, recently established in New York City, and similar schools in Boston and in certain other cities, are especially interesting. We have long been accustomed to the idea of trade schools for boys, but have until recently neglected to realize that there is the same necessity for training and instruction for girls. The results already achieved by girls' trade schools prove that, as in the case of boys, the trade school prepares for a type of work in which a living wage is secured and in which there is opportunity for advancement. The list of trade schools given in the bulletin of the National Society for the Promotion of Industrial Education follows:

SUPPORTED BY PUBLIC FUNDS.

The Manhattan Trade School for Girls, New York City; State Trade School, New Britain, Conn.; Worcester Trade School, Worcester, Mass.; Yonkers Trade School, Yonkers, N. Y.; Portland School of Trades, Portland, Oreg.; Philadelphia Trades School, Twelfth and Locust Streets, Philadelphia, Pa.; Milwaukee School of Trades for Boys, Milwaukee, Wis.; Girls' Trade School, 620 Massachusetts Avenue, Boston, Mass.; New York Trade School for Girls, Syracuse, N. Y.; Milwaukee School of Trades for Girls, Eighteenth and Wells Streets, Milwaukee, Wis.

SUPPORTED BY PRIVATE FOUNDATION.

Wilmerding School of Industrial Arts for Boys, San Francisco, Cal.; Winona Technical Institute, Indianapolis, Ind.; David Ranken, Jr., School of Mechanical Trades, St. Louis, Mo.; Paterson Silk Textile Institute, Paterson, N. J.; School of Science and Technology of Pratt Institute, Ryerson Street, Brooklyn, N. Y.;

Baron de Hirsch Trade School, 222 East Sixty-fourth Street, New York, N. Y.; New York Electrical Trade School, 39 West Seventeenth Street, New York, N. Y.; New York Trade School, First Avenue between Sixty-seventh and Sixty-eighth Streets, New York, N. Y.; Girard College, Philadelphia, Pa.; Williamson Free School of Mechanical Trades, Williamson School, Delaware County, Pa.; Miller School, Albemarle County, Va.; Hebrew Technical School for Girls, Second Avenue and Fifteenth Street, New York, N. Y.; Manhattan Trade School for Girls, 209–213 East Twenty-third Street, New York, N. Y.; Ezra F. Bowman Technical School, Lancaster, Pa.; Omaha Watch Repairing, Engraving and Optical Institute, Omaha, Nebr.; Horological Department of Bradley Polytechnic Institute, Peoria, Ill.; College of Horology, Broad and Somerset Streets, Philadelphia, Pa.; St. Louis Watchmaking School, St. Louis, Mo.; Waltham Horological School, Waltham, Mass.; Coyne National Trade School, 1701 N. Ashland Avenue, Chicago, Ill.; Master Plumbers Trade School, St. Louis, Mo.

TECHNICAL SCHOOLS: DAY COURSES.

"The schools included under this classification are of secondary grade and do not give instruction of higher engineering rank. The courses are designed to give the pupil such acquaintance with the scientific and mathematical principles underlying commercial processes as will enable him to qualify in time for the work of foreman, master mechanic, inspector, etc. Special attention is called to the group of textile schools, which are not trade but technical schools, in which both the practical and the theoretical aspects of textile manufacture are presented."

The following schools are supported by public funds: Bradford Durfee Textile School, Fall River, Mass.; Lowell Textile School, Lowell, Mass.; New Bedford Textile School, New Bedford, Mass.; Technical High School, Cleveland, Ohio; Louisiana Industrial Institute, Ruston, La. Supported by private funds: California School of Mechanical Arts, San Francisco, Cal.; Bliss electrical School, Takoma Park, Washington, D. C.; Lewis Institute, Madison and Robey Streets, Chicago, Ill.; Hebrew Technical Institute, 36 Stuyvesant Street, New York, N. Y.; Pratt Institute, Brooklyn, N. Y.; Webb's Academy for Shipbuilders, Fordham Heights, N. Y.; Ohio Mechanics' Institute, Cincinnati, Ohio; Drexel Institute of Art, Science, and Industry, Philadelphia, Pa.; Philadelphia Textile School, Philadelphia, Pa.; Carnegie Technical Schools, Pittsburgh, Pa.; High Schools of Practical Arts for Girls, Boston, Mass.

APPRENTICESHIP SCHOOLS.

Apprenticeship schools are provided by a number of large industrial corporations for the education of boys who are learning their trade. In these schools there is a close correlation of the theoretical instruction and the practical shopwork. Through training in mathematics, drafting, English, and science, there are recruited from the ranks of those who work in the shops a group of men much more capable than the ordinary worker. Sometimes from this group there are chosen those who occupy the higher supervisory positions. The movement is an indication of the desire of these corporations to supplement the work ordinarily done in the shop during the period of apprenticeship with a type of theoretical work which will develop a more intelligent workman. The fact that in most of these schools shop time is taken for the class work, and that this time is paid for at the regular rate, is an indication of the value attached to such exercises. The following is a partial list of such schools: Apprenticeship System of the New York Central lines; Apprenticeship Schools of the Santa Fe Railroad System; Apprenticeship School of the General Electric Co., West Lynn, Mass.; Yale & Towne Manufacturing Co.'s Apprentice School, Stamford, Conn.; School for Apprentices of the Lakeside Press, Chicago, Ill.; Solvay Process Co.'s Apprentice School, Syracuse, N. Y.; School of Printing of the North End Union, Boston, Mass.; Drawing School of the American Steel & Wire Co., Worcester, Mass.; Fore River Shipbuilding Co.'s Apprentice System, Quincy, Mass.; Ludlow Textile School, Ludlow, Mass.; Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; John Wanamaker Commercial Institute, New York, N. Y., and Philadelphia, Pa.

EVENING SCHOOLS.

Evening schools are more closely related to the apprenticeship schools than to any other of those already mentioned, since the students are recruited almost wholly from among those who work at the various trades during the day. They are intended to give a type of education, both theoretical and practical, which will give the worker at the trade a better understanding of his work and of its relationship to the industry toward which his work contributes. The tendency of shopwork is to confine the worker to one very small part of the whole industry and hence to give him very little appreciation of the significance of his labor, either in relation to the other processes in the same industry or to the industry in the larger social group. These evening schools, commonly called industrial improvement schools or continuation schools, follow a course of study not unlike the corresponding day schools. The following schools are of this type and give technical courses, and are supported by public funds: The Evening Industrial School, Boston, Mass.; Public Evening Trade School, Lowell, Mass.; Bradford Durfee Textile School, Fall River, Mass.; Lowell Textile School, Lowell, Mass.; New Bedford Textile School, New Bedford, Mass.; Evening Industrial School, Pittsfield, Mass.; Evening School, Little Falls, N. Y.; Stuyvesant Evening Trade School, 345 East Fifteenth Street, New York City; Brooklyn Evening Trade School, Brooklyn, N. Y.; Technical High School, Cleveland, Ohio. Schools giving technical courses and on private foundation are as follows: Lewis Institute, Chicago, Ill.; Franklin Union, Berkeley and Appleton Streets, Boston, Mass.; Lowell Institute School for Industrial Foremen, Boston, Mass.; Technical School, Newark, N. J.; Cooper Union for the Advancement of Science and Art, Astor Place, New York City; Mechanics' Institute, 20 West Forty-fourth Street, New York City; School of Science and Technology of Pratt Institute, Brooklyn, N. Y.; Mechanics' Institute, Rochester, N. Y.; Ohio Mechanics' Institute, Cincinnati, Ohio; Casino Technical Night School, East Pitsburgh, Pa.; Drexel Institute, Philadelphia, Pa.; Franklin Institute Night School, Philadelphia, Pa.; Philadelphia Textile School, Philadelphia, Pa.; Spring Garden Institute, Philadelphia, Pa.; School for Apprentices and Journeymen of the Carnegie Technical Schools, Pittsburgh, Pa.; Virginia Mechanics' Institute, Richmond, Va.

Throughout the United States the Young Men's Christian Associations have entered the field of industrial education. The work of the education department in city, railroad, and industrial Young Men's Christian Associations has become one of the most important of the activities of these organizations during the past few years. According to the report of the National Society for the Promotion of Industrial Education, there are now "2,250 paid teachers who give instruction to over 50,000 employees, men and boys, two nights per week for half the year, in a total of 140 different commercial and vocational subjects. Included in the above lines of class work are mechanical, architectural, and freehand drawing, design, shop mathematics, physics, electricity, chemistry, shopwork in wood and metal, plumbing, etc. This industrial work is not designed to prepare for the higher engineering lines, but on the contrary to furnish opportunities for industrial improvement, either by broadening the pupil's knowledge of a trade or by instructing him in the technical foundations of efficient and intelligent trade work." These associations are scattered throughout the United States. There are more than 60 associations, enrolling 50 or more students in trade and industrial subjects.

Schools giving practical shop courses and supported by public funds are found in the following cities: Cambridge Evening Industrial School, Cambridge, Mass.; Evening School, Chicopee, Mass.; Evening School of Trades, Springfield, Mass.; Long Island City Evening High and Trade School, Long Island City, N. Y.; New York Evening High School for Women, East Forty-second Street, near Third Avenue, New York City.; Stuyvesant Evening Trade School, New York, N. Y.; Philadelphia Trades School, Philadelphia, Pa. The following schools give practical shop courses and on private foundation:

Massachusetts Charitable Mechanic Association Trade School, 111 Huntington Avenue, Boston, Mass.; David Ranken, Jr., School of Mechanical Trades, St. Louis, Mo.; Five Points Italian Trade School, 155 Worth Street, New York City; Hebrew Technical Institute, New York City; New York Electrical Trade School, 39 West Seventeenth Street, New York City; New York Trade School, First Avenue, between Sixty-seventh and Sixty-eighth Streets, New York City; Manhattan Trade School for Girls, 209–213 East Twenty-third Street, New York City; School of Science and Technology of Pratt Institute, Brooklyn, New York City; St. George's Evening Trade School, 505 East Sixteenth Street, New York City; Sixty-third Street Evening Trade School of the Children's Aid Society, New York City; Drexel Institue of Art, Science, and Industry, Philadelphia, Pa.; Hebrew Education Society, Tenth and Carpenter Streets, Philadelphia, Pa.

PART-TIME SCHOOLS.

"The part-time plan, as carried on at Fitchburg, Mass., is an arrangement by which boys in the high school give half of their time to work for wages in the commercial shops in the city and half to school work. Such a plan is designed to furnish the pupil with the theoretical training necessary to his advancement in industrial life, while at the same time providing practical experience and wage return. The school work is under the direction of the board of education of Fitchburg and is supported by public funds. The classroom instruction articulates with the grammar school, and implies regular high-school requirements. For this part of the work the regular school building is used. For the first year the boy devotes his entire time to school work, and for the next three years equal groups of boys alternate weekly between shop and school, so that one group is always at work in the shops and one in the school. On Saturday morning of each week the boy who has been at school for that week goes to the shop in order to become familiar with the work upon which his alternate is working so as to be ready to take it up on Monday morning when the shop boy returns to school. Boys are paid for the work done in the shops at the rate of 10 cents an hour for the first year, 11 cents for the second year, and 12½ cents for the third year, or a total of $552.75 for the three years." Other part-time schools are found at Beverly, Mass. (The Beverly Industrial School) and at Cincinnati, Ohio (The Cincinnati Continuation School). All of these schools are publicly supported. Doubtless other schools of this type will be open in considerable numbers in the very near future.

TRADE SCHOOLS FOR THE COLORED RACES.

Some of the best industrial work that is done in the United States is to be found in schools for the education of Indians and negroes.

In all of these schools the industrial work is accompanied by literary instruction. In some of the schools as much as half of the time is devoted to industrial training. In some of the schools the relationship between industrial and the ordinary academic work is exceptionally well handled. This is peculiarly true in the subject of mathematics. The problems of the shop and farm are quite commonly treated in the classes in arithmetic, algebra, and geometry. "Normal instruction, instruction in the domestic arts and sciences, and giving each pupil such an understanding of a manual trade or agriculture as will make him financially independent and hence self-respecting—all these features together represent the aim of such schools as Hampton and Tuskegee Institutes and the other institutions in the list." Schools of this class are as follows: Hampton Normal and Agricultural Institute, Hampton, Va.; Tuskegee Normal and Industrial Institute, Tuskegee, Ala.; United States Indian School, Carlisle, Pa.; Christiansburg Industrial Institute, Cambria, Va.; Voorhees Industrial School, Denmark, S. C.; Schofield Normal and Industrial School, Aiken, S. C.; Manassas Industrial School, Manassas, Va.; Mayesville Industrial Institute, Mayesville, S. C.; Okolona Industrial College, Okolona, Miss.; Fessenden Academy and Industrial School, Fessenden, Fla.; Montgomery Industrial School for Girls, Montgomery, Ala.; Colored Industrial and Normal School, Salisbury, Md.; Manual Training and Industrial School for Colored Youth, Bordentown, N. J.

CORRESPONDENCE SCHOOLS.

Many persons who are regularly employed in the industries have sought help through the technical work which is offered by correspondence schools. With the persevering student, they have been able to conduct courses in a very great variety of technical subjects, and have in this way furnished the theoretical background which has made possible a wider outlook and a greater degree of efficiency for those who are regularly employed. The following schools are representative of the best type of this class: American School of Correspondence, Fifty-eighth Street and Drexel Avenue, Chicago, Ill.; International Typographical Union Course in Printing, 130 Sherman Street, Chicago, Ill.; International Correspondence Schools, Scranton, Pa.

The work of these schools is considered in another report to the International Commission on the Teaching of Mathematics.

SUBCOMMITTEE 1. INDUSTRIAL CLASSES IN PUBLIC SCHOOLS.

The subcommittee reporting on industrial classes in public schools included in its inquiry all schools supported and controlled by the municipality through its board of education. There were included, therefore, graded schools having a course of study of from seven to nine years in length, the technical and manual-training high schools, usually not coeducational, and the ordinary coeducational academic high schools. Evening schools of either elementary or secondary grade, as well as trade schools supported by the municipality as a part of the public-school system, were also considered. The term "industrial classes" was interpreted broadly to mean classes in manual training, domestic art, domestic science in either of the grades or high school, as well as classes in high-school commercial courses. Classes in vocational work in any of the schools named above were also included.

METHOD OF COLLECTING DATA.

A questionnaire was sent to 150 high-school principals and city superintendents in the larger cities of the United States, asking for data on the subject of "Industrial classes in public schools," and the relation of the work of these classes to the work in mathematics. While the response to this questionnaire was not as general or as full as could be desired, yet many superintendents cheerfully responded. It is largely on the basis of these replies that this report has been prepared.

KINDS OF INDUSTRIAL WORK GIVEN IN PUBLIC SCHOOLS.

Industrial work is given in public schools: First, in classes in manual training, domestic art, and domestic science throughout the grades of city school systems; second, in classes in manual training, domestic science, and commercial branches, conducted in the ordinary free academic high schools; third, in technical, manual-training, and commercial high schools; fourth, in evening schools of elementary or secondary grade; fifth, in vacation schools; sixth, in trade schools supported by the municipality and under the control of the board of education. In a few cases vocational classes are maintained in the free academic high schools; and in a very few instances in this country industrial work is given by a cooperation of public schools, and shops and factories. In these cases the boys work part time in the shop or factories and part time in the school.

CULTURAL INDUSTRIAL WORK.

In all parts of the United States a constantly increasing number of public schools have provided instruction in manual training, domestic art, domestic science, and commercial branches. The manual training consisting of whittling and bench work in wood is usually the first form of industrial work to be introduced. The next is sewing and dressmaking, followed by cooking. As public sentiment becomes educated to a more liberal support of this work, it is extended to all grades below the high school, and also to each year in the high school.

In answer to the question, "What kinds of industrial work are given in your school?" the following reply from one of the large cities in the Middle West is typical: "Strictly speaking, we do not give any industrial work in our public schools unless you would call manual training, domestic art, and domestic science, industrial work. (*a*) Handwork is taught the children in the first four grades (primary). This handwork consists of two kinds—first, work to illustrate subjects about which they read; second, independent unrelated exercises. In the fifth and sixth grades, boys are taught knife work by a special teacher, and girls sewing. In the fifth grade we give to this work one and one-half hours each week. In the sixth grade two and one-half hours a week. In the seventh and eighth grades boys are taught joinery and cabinetmaking in specially equipped shops; girls are taught cooking. Half a day a week is given to those subjects in the seventh and eighth grades. (*b*) We are now constructing two manual training high schools which will be ready for occupancy next fall. The manual training in these high schools will not take the form of industrial training, though it may develop into that later. At present in the high schools we have a very complete commercial department which fits pupils for business life and for clerical work. We also teach mechanical drawing, free-hand drawing, and applied design, with some work in the crafts."

From another large city where the high school industrial work was much more extensive, the following reply was received: "In our high schools, sewing, millinery, carpentry, blacksmithing, machine-shop practice, wood turning, architectural drawing, and mechanical drawing are given."

For the most part the lines of industrial education named above furnish the basis for work in the trades rather than direct instruction in the trades.

VOCATIONAL INDUSTRIAL WORK.

Besides the above lines of work there are in some schools strictly vocational classes. Many school boards maintain evening schools of elementary and secondary grade. Much of the work in these schools is vocational. It includes one or more of the following: Millinery, dressmaking, flowermaking, chauffeur's work, wood turning, cabinetmaking, architectural drawing, mechanical drawing, stenography, bookkeeping, and other trades of local interest. Of course the high school commercial courses prepare directly for business life and for clerical positions. Trade schools for girls, evening grammar schools, evening high schools, technical high schools, manual training high schools are forms of schools in which industrial work is prominent. In all of these two kinds of industrial work are carried on—first, that which furnishes a basis for trade or technical instruction, but which is itself not directly trade instruction; second, strictly vocational work.

COOPERATIVE INDUSTRIAL WORK.

A very interesting experiment is being tried in a few cities in this country—the so-called cooperative industrial work. Under this plan boys work one week in the shops or factories and the next week in the public schools. The work in school is such as will directly affect their efficiency in the shop. This plan gives boys their industrial work in the shops and their academic work in school. The academic work is correlated with the shopwork. A number of other cities are planning to try this experiment.

PUBLIC SCHOOL INDUSTRIAL WORK AND LOCAL INDUSTRIES.

Of the cities from which answers to the questionnaire were received very few stated that the work offered in manual training and domestic science is, in any special way, modified to fit the local industries, while several stated that no such relation exists. The following reply is from one of the large cities of the East: "No special attempt has been made * * * in public school work to fit pupils especially for local industries. We have such a variety of local industries that it would be impossible to train especially for certain ones and not for others."

Where evening and trade schools are maintained, a very definite relationship exists between the trades taught and the local industries. Those trades that are carried on in the city where these schools are located are taught in the schools.

ARE PRESENT CONDITIONS SATISFACTORY.

In general, superintendents seem to feel that the industrial work now given is satisfactory as far as it goes. Many express the opinion that more time should be given to the work and greater diversity should be introduced.

The following reply is from a superintendent who has this point of view. He says: "We do not feel that we have really made a beginning in meeting the demand for industrial education. The crowded condition of our schools prevents any advanced steps in this direction. We aim as soon as possible, however, to establish schools which will give greater training along a number of lines of activities."

Another superintendent writes as follows: "Our present industrial work is not satisfactory, if it is thought advisable to give vocational training. I am not satisfied yet that vocational training should be introduced into public schools. However, I am open to conviction. We are hoping to try a plan of part-day school and part-day work in the shops and in other vocations. If this plan works out satisfactorily it will mean that we will use the shops and factories of the city for the practical work, while the academic and theoretical work will be given in the schools."

Still another superintendent writes: "We want more work of an industrial nature in the schools we have. We want a thoroughly equipped industrial plant in our high school. We want a school that will give students a thorough training in all departments of the silk industry, our leading industry, and its associated occupations, the manufacturing of silk machinery, etc. We should do something for the young men who follow the iron and steel industries, locomotive building, structural-steel work, etc."

THE MATHEMATICAL CURRICULUM.

It is customary to give a course in arithmetic through the grades, beginning in the first or second grade and extending through the eighth. In the eighth grade a course in constructive geometry is given and sometimes one in elementary algebra.

In the academic high schools having four-year courses the customary course in mathematics is given as follows: One year of algebra is required, and this is usually given in the first year of the high-school course; one year of geometry is also required in most high schools. Sometimes it is a year of plane and solid geometry, given, as a rule, in the third year of the high-school course. Sometimes the one-year course is devoted entirely to plane geometry; then it is usually given in the second year of the high-school course. Arithmetic is generally required in the commercial courses, and in some high schools it is required in other courses also. In addition, in the third or fourth year of the high-school courses a half year of advanced algebra and a half year of solid geometry are offered as electives, and then plane geometry only is required.

The following course in mathematics, given in one of the largest high schools in the Middle West, is typical of the work given in schools of this class: In the first year, algebra; in the second year, plane geometry; in the third year, solid geometry and advanced algebra; in the fourth year, trigonometry. The instructor in mathematics in this school writes as follows: "A modification of this course that would possibly be an improvement is the introduction of elementary solid geometry propositions, and trigonometry notions in a first course in geometry, to be given in the second year; the remainder of solid geometry together with the most difficult plane geometry propositions, to constitute an advanced course, coming in the third year. This would permit of the introduction of a wide range of extremely interesting problem material into the geometry course."

RELATION OF MATHEMATICS TO INDUSTRIAL WORK.

The general tenor of the replies received indicates that a greater effort is being made to correlate mathematics taught in the grades and in the high school with manual training, domestic science, and other industrial work offered in these schools. As a rule in academic high schools, separate classes in industrial mathematics are not conducted. In evening and trade schools, the mathematics offered is taught frequently by the instructor in the trade. In this case, the mathematics taught is such as will be useful in the given trade. Shop formulas are taught; these formulas are applied to practical problems and the meaning of the formulas is made clear. Emphasis is placed, primarily but not exclusively, on the empirical use of the formulas instead of on the demonstrative side as in high-school mathematics. In the Washington Irving High School in New York City, a technical high school for girls, the course in mathematics follows a course made by the domestic art and commercial departments of the school.

The following replies to the questionnaire will indicate in greater detail what is being done along the line of industrial mathematics and the effect industrial work is destined to have on mathematical teaching.

From a large city in the East is the following reply: "Industrial mathematics is taken up in the Technical Evening High School, and in the vocational schools. In each case, separate classes are held for mathematics, but it is correlated as much as possible with shopwork. The demonstrative side is not emphasized particularly, neither are formulas given empirically. Our instructors try to show the reason why and to make the rules and formulas logical deductions. I have no doubt that with the growth of industrial work in the schools a system of shop mathematics will be evolved, beginning with arithmetic and extending certainly through geometry, which will apply particularly to the industries."

Another superintendent writes: "No work in industrial mathematics is given. Use is made of practical problems and applications of mathematics to the arts and sciences because experience has shown that such problems add interest to the work."

A third superintendent in one of the large Western cities says: "There is nothing special in our course of study known as industrial mathematics. I think, however, that there is need for work of this kind. In connection with manual training, mathematics especially suited to this kind of work is, of course, used. The same is true in regard to various lines of manual activities offered in the Manual Training High School. There is no doubt that the public school industrial work will tend to make arithmetic, taught in the elementary schools, much simpler and more practical in its character."

A principal of one of the large high schools in the Middle West says: "Shop arithmetic is given with class lectures and work in the shop. Application is emphasized. No attention whatever is paid to demonstration. There is no correlation at present between mathematics and industrial work. In the near future, the mathematical subjects will have to treat their problems and theorems as some part of the world in which we live, and not as something that pupils think exists in imagination. Industrial work will make demands on the pupils which will require them to get their mathematics in organized shape and hold it ready for every emergency."

In a large city in the Middle West the practical side of mathematics in the grades is emphasized by supplying pupils with mimeographed sets of questions and problems such as would arise in buying familiar articles at the meat market, at the grocery department, or at a department store in its various departments. These problems are arranged to bring out the idea of economical buying of articles needed for a meal and of buying articles needed in the various phases of domestic work. Problems are given on the cost of heating and lighting a house by gas and by electricity. In this case, statement is made of the number of feet of gas used, and the number of kilowatts of electricity used, and pupils are required to compute the monthly bill, for these items. Problems are also given relating to the practical work of different industries, such as railroad and foundry problems, pay rolls, cost of house furnishing, etc. Data are given of the amount of money spent by the city in each of the various kinds of city improvements, and the amount of improvement made, for example, the number of miles of street paved in brick, in asphalt, etc. From these data a large number of problems are developed. It is evident that problems of this kind connect directly with the child's home life, with the industrial life, and with the civic life with which he is familiar.

CHANGES NEEDED IN THE MATHEMATICAL CURRICULUM.

The changes needed in the mathematical content and curriculum are along the lines indicated in the foregoing. The principal of one of the largest high schools in New York City says: "The mathematical courses need reformation. What can any sort of mathematics do for the ordinary man, the ordinary woman, the industrial worker, the housekeeper? Get this mathematical desideratum expressed in terms of power and information, and then plan your course in mathematics to produce the outlined purposes. At present the procedure is, 'Every high school has algebra and geometry. We'll have them too.' Neither of these subjects springs out of the needs of the students, nor is it concretely directed toward equipping the students with any useful knowledge or power."

The following quotation sums up the opinion expressed in the large majority of the replies received: "Some of the less essential should be eliminated * * * and more drill given to concrete problems involving home and industrial life."

REQUIRED AND ELECTIVE MATHEMATICS.

The opinion of a large majority of principals and superintendents, answering the questionnaire, is expressed by the following quotation: "Elementary algebra and plane geometry should be required of all. All should have at least this amount of mathematics so as to appreciate the disciplinary and practical value of this branch of human knowledge. Algebra and geometry are essential to a study of the sciences. Higher algebra and solid geometry may with profit be made elective."

The following quotation expresses a more radical view: "If algebra and geometry must come at the beginning of the course, I would make both elective on account of the immaturity of most beginning students. The great modification that I would suggest in high school mathematics would be a shifting of the whole matter at least one year higher in the course, using the first year for language, history, and science subjects."

PROPOSED FUSION OF DIFFERENT BRANCHES OF MATHEMATICS.

The general opinion of those answering the questionnaire is that algebra and geometry should not be fused into one course in mathematics, nor should plane and solid geometry be fused. The following is a typical quotation: "Algebra and geometry should not be fused. By such a plan students will gain very little knowledge of either." Algebra should precede geometry. The step from arithmetic to algebra is much easier than from arithmetic to geometry. Arithmetic and algebra are more closely related. Plane and solid geometry should not be fused.

The opinion is very generally expressed that, while it is undesirable to make the fusions spoken of, a very much closer relationship should exist between the different branches of mathematics offered in the high school.

ORDER OF MATHEMATICAL STUDIES.

The quotations given above and many others of similar nature that could be given, express the prevailing opinion that algebra should precede demonstrative geometry, though a course in constructive geometry should precede algebra. Plane geometry should precede solid geometry.

THE UTILITARIAN SIDE OF MATHEMATICS IN THE PUBLIC SCHOOLS.

"In what ways is stress placed on the utilitarian side of mathematics?" was one of the questions asked. This is a question to which few satisfactory replies were received. The principal of one of the largest technical high schools in the Middle West says: "Use is made of practical problems and applications of mathematics to the arts and sciences because experience has shown that such problems add interest to the class work."

Another principal says: "In the grades no special stress is placed on the utilitarian side except that we attempt to find worthy concrete problems. In the Manual Training High School shopwork is made the basis of many problems in arithmetic and geometry. The commercial course in the high school aims to be altogether practical."

A superintendent of a large eastern city says: "Commercial arithmetic is studied as a regular subject in the business course, and all work in manual training is from drawings and plans, requiring mathematical computations."

Another superintendent states: "Material for problems in all grades is drawn from home and store and general outside experience. Printed forms, bills, and blanks of various kinds of business are used in the classroom, tax bills, gas bills, etc. Pupils are required to compute the customary discount on these bills."

MATHEMATICS AND APPLIED SCIENCES.

The replies indicate a general tendency to use in the work in mathematics problems from the applied sciences, models, etc., to make the work more effective. The following are quotations from the answers to this phase of the inquiry: "Problems of parallelograms of forces, falling bodies, immersed solids, solids made in the manual training department are used." "Problems in elementary mechanics, cardboard models, and similar devices are used." "Sectional models should be used as foundation work in mensuration in the grades and in the high school. All instruments and machines from which problems are drawn should be, so far as possible, studied, and from these the results should be verified."

CORRELATION OF DIFFERENT LINES OF MATHEMATICS.

Relatively few schools indicate any considerable attempt to correlate the different lines of mathematical work in school. A very large number of schools make no reply to this phase of the inquiry. Some report that no correlation is attempted. A few report that work along this line is carried on: "Algebraic methods are used in geometry work; algebraic results and formulas are illustrated geometrically; logarithmic computations of volumes is made in solid geometry." "Algebra and geometry, while not taught together, are made interdependent as much as possible."

DRAWING AND GEOMETRY.

Is the fundamental relation between drawing and geometry emphasized? If so, how? To this question few answers were received. The following are some of them: "Yes. In mechanical and architectural drawing." "The course in mechanical drawing, given in the first year, is introduced by the graphical solution of a number of geometric construction problems." "No. The drawing teacher teaches perspective, for instance, which is a direct application of geometry and optics, without any reference to either subject. I doubt if any drawing teacher ever was taught the connection." "The fundamental relation between geometry and drawing is emphasized both in the grades and in the high school, in manual training, in arithmetic, in geometry, and in mechanical drawing." "Very strongly. We give an eight weeks' course in preliminary geometry, and insist on accurate drawings all the time." "Mechanical drawing is applied geometry, and its relations are made use of perforce in all mechanical drawing and drafting for industrial work." These quotations serve to illustrate that in spite of some divergence in opinion the importance of this phase of the work is coming to be recognized in schoolroom practice.

EDUCATIONAL MUSEUMS.

Very few of the cities heard from report that they are equipped with a mathematical museum. Very many of those who replied indicate a belief in the value of such a museum, as the following quotations show: "Undoubtedly a collection of models, instruments, pictures, etc., would be of great value." "We believe it has some value, but it is not essential." "It is too bad that we have not such a museum." "Illustrative material is always of value. It stimulates interest and self-activity." Occasionally a pessimistic note is heard as the following: "I never saw an educational museum that was worth anything, chiefly because it was so administered that the teachers would not take the trouble to use it."

CONCLUSION.

These replies, which were received from cities in all parts of the United States, indicate a strong tendency to increase the amount and variety of industrial work offered in public schools.

Where trades are taught instruction in shop mathematics is given usually by the instructor in the trades. The work as given in these classes in shop mathematics is adapted directly to the trades taught. In the regular mathematical work in the public schools no great change in the mathematical curriculum is demanded.

The effect of the industrial work is, therefore, to introduce into all lines of public-school mathematics a larger number of problems related to the industrial work done in school, to the industries carried on in the community, to the actual life of the child and his home, and to the civic enterprise of the city.

SUBCOMMITTEE 2. CORPORATION INDUSTRIAL SCHOOLS.

In corporation industrial schools the type of work done in mathematics varies with the demand for mathematical knowledge in the work carried on by the corporation. In one school, as, for example, the John Wanamaker Commercial Institute, the work will consist mainly of commercial arithmetic. In another school the mathematical curriculum will extend to a knowledge of algebra, geometry, and possibly trigonometry because of the need for understanding formulæ which must be applied in machine shops. In these schools, as has been suggested above in the discussion of apprenticeship schools, there are found boys who have had from six to eight years of elementary school work, with an occasional boy who may have had some work in high school. With this rather meager equipment, and with the large need for mathematical knowledge which must be applied to shopwork, it becomes apparent that the problem of the shop school is largely one of getting before the class problems which deal with actual shop conditions and teachers who understand shopwork, as well as theoretical mathematics.

Our standard textbooks deal with mathematics in a general way, covering many subjects which have no connection with manufacturing industries. This being the case we can not use the existing textbooks for problem work, and therefore it falls upon the instructor to write the problems required. These problems must, of course, follow in order the usual textbook classification. Since each kind of industry requires problems adapted to its production, no one book can provide problems for all industries requiring trade knowledge. However, one textbook can cover sufficiently the industries representing the manufacture of machinery, engines, and electrical equipment.

The problems must not only follow textbook classification, but they must be in fact what they purport to be, namely, shop problems. In the writing of these problems it is absolutely necessary that the instructor should be a man who has had shop experience and one who is familiar with the various departments and in touch with factory conditions.

These problems will involve not only a knowledge of the machines in use but an intimate knowledge of the factory production, stock departments, and piecework rates. This knowledge is necessary because the shop boy is quick to note an error in dealing with factory work, and he is equally quick to lose confidence in the instructor who shows a lack of shop experience.

The work in arithmetic, algebra, geometry, and trigonometry in schools of this type is not sharply differentiated as in the ordinary school. In order to indicate something of the nature of the relationship which exists among these subjects, as well as to give some idea of the subject matter covered and the method of instruction, the program of work carried out under the direction of Maj. A. W. Lowe, superintendent of educational classes for the General Electric Co., West Lynn, Mass., is given in the following pages:

ARITHMETIC.

Having written the problems, the next step is to have the apprentices work out the values. One method of teaching the above subject is to have the problem given in the usual way; then substitute literal values for the numerical values previously given and put the problem in the form of an algebraic statement; then substitute a set of numerical values for the literal quantities and solve the problem.

I give herewith specimen examples:

Problem 1. Brass castings are worth 23.25 cents per pound; cast-iron castings, 3.75 cents per pound; malleable-iron castings 4.68 cents per pound. During one week 5,980 pounds of malleable-iron castings, 8,760 pounds of brass castings, and 21,900 pounds of cast-iron castings were shipped. What was the value of the castings sent out?

Problem 2. Brass castings are worth (a) cents per pound; cast-iron castings, (b) cents per pound; malleable-iron castings, (c) cents per pound. During one week (d) pounds of malleable-iron castings, (e) pounds of brass castings, and (f) pounds of cast-iron castings were shipped. What was the value of the castings sent out?

Problem 3. Using the literal quantities of problem 2, let (a) = 27.5, (b) = 3.8, (c) = 4.38, (d) = 6,830, (e) = 7,240, and (f) = 2,250. What was the value of the castings sent out?

Problem 4. With a good quantity of coal the average coal consumption is 1¾ pounds per indicated horsepower per hour for a 1,400 H. P. triple-expansion engine running condensing. How long will it take to consume 250 tons of coal, providing the engine averages a 14½-hour run for each 24 hours?

Problem 5. With a good quantity of coal the consumption is (a) pounds per indicated horsepower per hour for a (b) H. P. triple-expansion engine running condensing. How long will it take to consume (c) tons of coal, provided the engine averages a 16½-hour run for each 24 hours?

Problem 6. In problem 5 let (a) = 1¾ pounds, (b) = 1,250 H. P., and (c) = 135 tons. How long will the supply of fuel last?

It is an excellent method of introducing to the apprentice the first steps in algebra, and my experience shows that the boy by this method grasps the idea of algebra much more quickly than by the usual "cut and dried" methods.

ALGEBRA.

A portion of the arithmetic class period should be set apart for the study of elementary algebra.

It may be argued by some that the study of algebra is not necessary in an industrial education. To such I will say that the study of algebra is necessary to a proper understanding of the formulæ which the boy will be called upon to use in his later work.

In the teaching of this subject great care must be exercised by the instructor in that his explanation of elementary principles must be so clear and concise as to enable the boy to understand the very foundation of algebra. Much attention is given to the use of the formula and the simple equation.

PLANE GEOMETRY.

In the teaching of plane geometry we give the boy instruction relating to the line, and plane figures. He is held to a rigorous explanation of the theorem and the class is not allowed to pass to the next theorem until the one under discussion is thoroughly understood. Wherever possible, the attention of the boy is called to a practical application of the principle involved. This arouses the interest of the boy, for the subject then has a meaning and its application is tangible and not imaginary.

In connection with the geometry the subject of mensuration is taught. In problems involving weight the boy first calculates the weight and then checks this calculation by weighing the article.

If there be a difference in the two results then the boy must prove whether or not the calculation is correct. He finally decides that the error is due to his mistakes in the calculation. With the area of a plane surface a similar method is followed and the boy must measure the surface and compare the result with his calculated area.

A few specimen problems are given below:

Problem 1. A cylindrical oil tank is to be made 30 inches in diameter and long enough to hold 200 gallons. Find the length.

Problem 2. The handwheel of a rheostat is 5¼ inches inside diameter and 7¼ inches outside diameter and cross section 1 inch in diameter. The hub is 1¼ inches in diameter by 1¼ inches long and the bore is one-half inch in diameter; connecting the hub and hand part are 4 spokes each one-half inch in diameter. Find the weight, if made of C. I.

Problem 3. The concentric diffuser of an arc lamp is conical shape, 40 inches in diameter and 8 inches high. If the upper rays of light strike the surface 6 inches from the base, find the amount of reflecting surface used.

Problem 4. One part of a friction brake is of the shape of the frustum of a cone. The outer surface of the frustum is 8 inches in diameter and the top is 6 inches in diameter; the height is 1¼ inches. What is the angle at the center for the development of the leather, and what is the radius for the base and for the top?

TRIGONOMETRY.

This ends the subject of mathematics as pure mathematics. It has been proven repeatedly in shopwork that a working knowledge of trigonometry is one of the most valuable assets a shopman can possess. On large, and sometimes small, layout work a knowledge of this subject is absolutely necessary, for oftentimes an exact dimension must be given and the work must be finished to that dimension.

Our boys are given instruction in trigonometry through the solution of the oblique triangle. Not all the examples or problems are given to the class, but enough are given to enable the boy to handle any problem which he will be called upon to solve in the execution of his shopwork.

He is given thorough instruction in the fundamental principles of the subject, and his knowledge of these principles is thoroughly tested.

A few specimen problems are given below:

Problem 1. Three holes are so located on a casting that the lines connecting their centers form a right triangle. A is an acute angle of 28 degrees and the hypothenuse (c) is 11 inches. Find the sides a and b.

Problem 2. A cast-steel exhaust flange is 26 inches in diameter, is 1¼ inches thick, and has 8 bolt holes nine-sixteenths inch in diameter and exhaust opening 6 inches in diameter. What is the surface area? What is the weight? What is the distance between the centers of any two consecutive bolt holes? If one-eighth inch was allowed for machining, what is the original weight of the casting?

Throughout such a course as is outlined above, the real test of the boy's knowledge of his theoretical work is found in his ability to apply the principles supposedly mastered, to what are usually termed practical problems. In the work at West Lynn the boy's knowledge of mathematics is applied to mechanics, power of transmission, strength of materials, calculating machine parts, magnetism, and electricity.

Mr. Gardner, of the School for Apprentices of the New York Central Lines, characterizes their work in the following language:

Stress is laid upon the practical and commercial side of the mathematical instruction. Every example is clothed in the language of the shops and is illustrated by actual practice in the boy's daily work. For example, the boy learns ratio and proportion by figuring the change gears for cutting different screws in his lathe, and the principles of leverage are demonstrated by the throttle and reverse lever on the locomotive and the brake rigging on the car. No attempt is made to teach subjects promoting general culture. The system is not philanthropic, but is a hard and fast business proposition firmly fixed upon a paying basis.

Things are not taught that are interesting to the teacher, but those that are useful to the student. The apprentice needs a working knowledge of elementary mathematics, but the vital point is that it should be elementary and that it must be a working knowledge. The problems are not regarded as affording a complete program of study in itself, but always form part of a regular course planned in accordance with the trade the boy is following.

Arithmetic, algebra, geometry, physics, and practical mechanics are fused so completely that the student knows no study by any name but arithmetic. It has not been found expedient for skilled mechanics in railroad service to acquire a knowledge of higher mathematics.

All conventional limits between all branches of mathematics are suppressed. Mathematics is taught by lesson sheets. Each boy takes two sheets of problems home per week, each sheet containing an average of seven problems. In the classroom and laboratory two sheets of practical problems capable of actual demonstration are finished per week. Bright boys may do as many more at home or in the classroom as they wish.

The boy is taught by the instructor and his assistant, and is not told how to do examples, but is asked how to do them. Groups of boys are instructed in the laboratory by the shop or classroom instructor. Instruction is very informal, and friendly discussions are encouraged between the boys and the teacher, consistent with order and discipline.

Leverage models for problems in all classes of levers, racks containing gears, and lathes for studying the properties of gearing, wheel and axle model, pulley blocks, inclined plane, screw jack, etc., are used. A small upright engine is used in the laboratory for teaching valve setting. Models of the Stephenson and Walschaert valve gears are studied and small scale models of engine wheels and frames are employed for teaching boys the practical way of laying out keyways for axles and eccentrics and for setting the shoes and wedges which are used in the main driving-wheel journals of locomotives. A small tension and compression machine is used for a course in strength of materials.

Sample sheets of home problems used in the apprenticeship schools of the New York Central lines follow:

If a raise of pay of 10 per cent is made in a man's wages it means that one-tenth of the present amount will be added to it. If his rate is $2.50 a day one-tenth of this is 25 cents, and his new rate is $2.75.

Suppose now our man getting $2.75 a day was cut 10 per cent; what would he receive? 2.75+10/100=0.275, and $2.75—0.275=$2.47½, which is less than he got in the first place before he was raised 10 per cent. We thus see that a 10 per cent raise is less in amount than a 10 per cent cut. This is because our base for the cut is a larger sum than the base for the raise.

When we say an engine or motor is 85 per cent efficient, we mean that we are getting 85 parts of work out of a possible 100. When we say a certain quantity of coal contains 65 per cent carbon and 1 per cent sulphur, we mean that 65/100 of any amount of this coal is carbon and 1/100 is sulphur. We do not mean that 65 pounds are carbon and 1 pound is sulphur.

RATIO AND PROPORTION.

1. If a planer has a cutting speed of 30 feet per minute and a return speed of 147 feet per minute, what is the ratio of the cutting speed to the return speed?

2. What ratio is the area of the steam port to that of the exhaust port on an engine having a steam port of 24 square inches and an exhaust port of 36 square inches?

3. The dead load of a 50-ton freight car, consisting of the weight of the car empty and the trucks, is 42,600 pounds. The live load, or the weight of the freight carried, is 108,000 pounds. What is the ratio of the live to the dead load?

4. If the car in the above problem had only carried 37,400 pounds of freight, what would have been the ratio of the live to the dead load?

5. What is the ratio of the dead to the live load in a passenger coach where the car and trucks weigh 90,450 pounds, and the passengers weigh 4,500 pounds?

6. On a 36-inch planer the ratio of the cutting speed to the return speed of the table is 1 to 2.94. With a return speed of 50 feet per minute, what is the cutting speed?

BOILERMAKER'S HOME PROBLEMS.

1. How much will it take to shear a three-fourth inch steel rivet if the shearing strength of the steel is rated at 45,000 pounds per square inch?

2. The tensile strength of boiler plate is 55,000 pounds per square inch. How many pounds would it take to pull apart a piece of plate 24 inches wide by three-fourths inch thick?

3. Two one-half inch plates A and B (fig. 27) are joined by two 1-inch rivets in a single-riveted lap joint. Suppose the plates were pulled part, the plate B tearing between the rivets on the line X X X. If the tensile strength of the plate is 55,000 pounds per square inch, what was the pull in pounds which tore the plate?

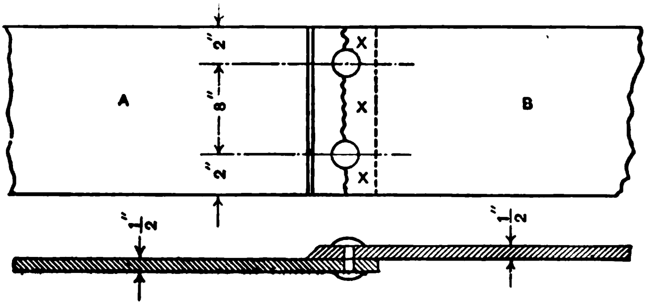

FIG. 27.

4. With the same plates as in the last problem, what pull would tear the plate if the rivets were three-fourth inch instead of 1 inch?

5. If the shearing strength of the rivet iron (fig. 27) is 45,000 pounds per square inch, how much would the two 1-inch rivets stand before they would be sheared off? How much would it take to shear them if they were only three-fourth inch in diameter?

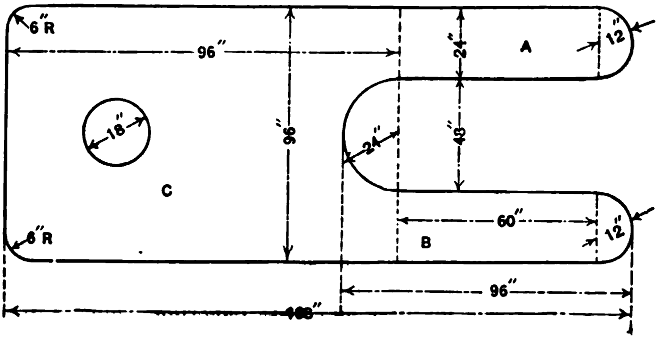

FIG. 28.

6. In the joint shown in fig. 27, if the rivets are 1 inch diameter and the plate one-half inch thick, which will give way first, the rivets or the plate?

GENERAL CLASSROOM PROBLEMS.

Fig. 28 shows the top sheet of a tank made of one-fourth inch steel plate. Divide the figure into 3 rectangles, as shown by the dotted lines. Use Machine Shop Arithmetic, page 137, for all circular areas.

1442°—11——12

Find area of rectangle A in square inches; find area of rectangle B in square inches; find area of rectangle C in square inches; find area of manhole in square inches; find area of 24-inch half circle in square inches; find area of two 12-inch half circles in square inches; find area of two 6-inch corners in square inches; subtract the two corners, the 24-inch semicircle and the manhole from rectangle C, then add this area to A and B and then add to these the 24-inch circle made by the ends of the two legs; what is area of finished plate in square inches; what is area of finished plate in square feet; what is weight of finished plate in pounds?

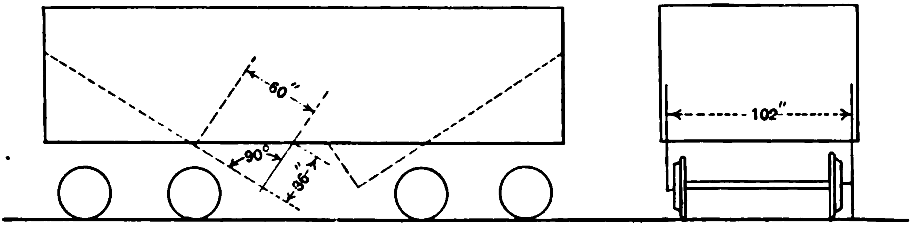

FIG. 29.

Find the weight of coal which is contained in the two hoppers of the hopper-bottom gondola car shown in Fig. 29. Find the area of the triangular end of one hopper and multiply this by the length of the hopper. The shape of the hopper is a triangular prism.

Remember that 1,728 cubic inches make 1 cubic foot and that 1 cubic foot of coal weighs 45 pounds.

Consider the top side of the hopper to be flush with the floor of the car.

Area of two triangular ends, square inches; volume of two hoppers, cubic inches; volume of two hoppers, cubic feet; weight of coal in two hoppers, pounds.

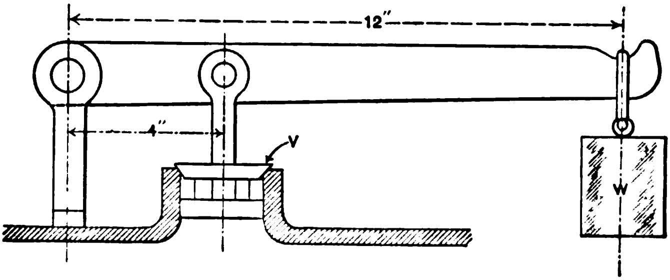

FIG. 30.

In all leverage problems the first and most important thing is to find and locate the fulcrum. The fulcrum is the point which determines the moment arms from which we get the required answer.

The moment arm is always the distance from the fulcrum to the force or weight.

1. A safety valve V on a stationary boiler is loaded with a 50-pound weight at W. (Fig. 30.) Find the total steam pressure on V necessary to open the valve.

2. If the weight was changed to 75 pounds and the distance from the center line of the valve to the fulcrum was made 3 inches, how much steam pressure would it take to open the valve?

3. A stationary boiler is to carry 50 pounds per square inch steam pressure. The safety valve is 2 inches in diameter. If the lever is designed as in Fig. 30, how heavy a weight must be used? Give answer to nearest even pound.

4. What class of lever is shown by Fig. 30.

1. Fig. 31 shows a tender-brake rigging operated by an 8 by 12 inch air cylinder. If the piston moves 8 inches, how far will the push rod move?

2. Draw the similar triangle diagram for problem 1 on the blackboard and mark plainly all dimensions and distances moved.

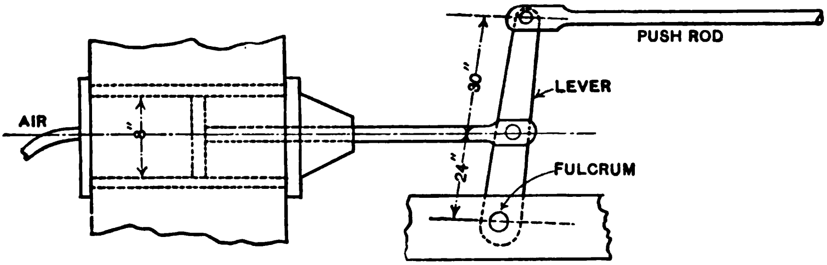

FIG. 31.

3. If the air pressure in the brake cylinder was 90 pounds per square inch, what would be the force transmitted by the push rod?

Fig. 32 shows an air hoist using a regular shop tackle with two pulleys in the lower, or movable, block and two in the upper block. The loose end of the rope is fastened to the upper block. This arrangement is useful when it is necessary to have a good deal of power with a low lift.

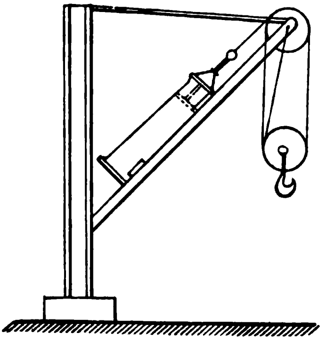

FIG. 32.

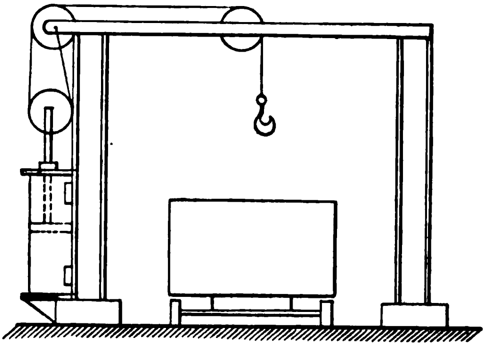

FIG. 33.

1. If the total lift required for the hoist shown in Fig. 33 is 3 feet and the heaviest casting weighs 12,000 pounds, what length of cylinder would we need, allowing 2 inches additional for clearance?

2. In the above problem, what power must we have on the piston?

3. The hoist shown in Fig. 33 has three pulleys—one on the piston rod and two on the structure. If it is required to lift a maximum load of 9,000 pounds with an available air pressure of 80 pounds per square inch, what size cylinder should be used? Give answer to nearest even inch.

SUBCOMMITTEE 3. PREPARATION OF TEACHERS OF MATHEMATICS FOR TRADE AND INDUSTRIAL SCHOOLS.

The committee charged with the investigation of the preparation of teachers consider the character of the preparation which teachers of mathematics have had who are now employed in trade schools or in schools which emphasize the practical element, and also the changes in preparation for this work which are desirable, and how such changes may be brought about. As a preliminary to the two main inquiries it was also thought to be desirable to investigate briefly the status of mathematics teaching in practical schools in order to determine the relative importance of the subject as indicated by the amount of time given to it and by the character of the teaching. With these objects in view about 25 schools were chosen, located in widely separated sections of the United States, including all the day and evening trade schools, public or private, known to the investigator, and also about the same number of technical or industrial schools having a more general vocational aim; and to these were sent the following questionnaire:

1. Is mathematics taught at all in your school? If so, kindly indicate the extent in hours per year (*a*) of theoretical mathematics; (*b*) of applied mathematics.
2. Is mathematics in your school taught by one or more specialists in that subject, by a teacher of other subjects, or by both classes of teachers? (*a*) Number of special teachers of mathematics; (*b*) number of teachers of other subjects who give mathematical instruction.
3. Outline briefly the character of the preparation which your teachers of mathematics have had, whether specialists or not.
4. What facilities for preparing teachers of mathematics for trade-school work are known to you?
5. Do you feel the necessity of extending the facilities for such preparation; and if so, what recommendations would you make in regard to it?

The responses to this questionnaire were prompt and generally complete. There was a wide range in the statistical replies called for in the first two questions, as might be expected from the varied character of the schools to which the questionnaire was sent. There would be no value in tabulating these returns. The significant facts determined were that nearly all the schools give some instruction in theoretical mathematics, only two reporting "no instruction," and all reported that they give some instruction in applied mathematics. The greatest number of hours of instruction in theoretical mathematics is 440 hours per year and in applied mathematics 988 hours per year. This is so far in excess of the average that it seemed somewhat abnormal. These figures were reported by the director of a trade school connected with a certain large manufacturing interest. Aside from this extreme example the average time devoted to theoretical mathematics may be said to be about 300 hours covering a period of one and one-half years, while the average time devoted to applied mathematics is 210 hours covering about the same time. Several of the reports, however, recognize no distinction between the theoretical and the applied mathematics, but give the average amount of time to the subject as a whole. There is some reason in this view of the case, inasmuch as theoretical mathematics should be, and presumably is, taught in practical schools not for mental discipline, but for its utility as a necessary part of the equipment of the worker in a shop or factory. It is, in fact, very difficult to draw the line between theoretical mathematics taught with a practical aim and applied mathematics.

The replies to the second question indicated that about the same number of special teachers of mathematics are employed as those who teach mathematics as a part of their work. The reports indicate, however, a tendency in the direction of the employment of special teachers. In all large schools the special teacher is the rule, though one large industrial school reported only 3 special teachers of mathematics and 13 who teach other subjects as well. This is evidently an exceptional instance. Most of the schools reporting a mixed program for teachers of mathematics were small schools in which such a policy is a manifest necessity. There seemed to be recognition of the idea that mathematics teaching, to be most effective, should be in the hands of special teachers trained by study and by experience for this work.

Turning now to the first of the two main points of our inquiry viz, the character of the preparation which teachers of mathematics in practical schools have had, the reports indicate that college graduates and graduates of engineering schools largely predominate, though in a few instances the highest training was received in normal schools. It should be said, however, that all the reports emphasized the fact that, in the selection of teachers, much weight was given to practical experience in the shop or drafting room as a necessary element in the training of teachers of mathematics in practical schools. Such training is manifestly essential to effective work in applied mathematics. Speaking of the teachers of applied mathematics, the director of the School of Industrial Foremen in Boston says: "They are teachers of many years' experience in mechanical and electrical engineering subjects, but have not specialized in mathematical work. Such teachers are much better able to get the point of view of men carrying on work in the drafting room, shop, or factory than is possible for a teacher whose experience is limited to mathematical instruction pure and simple." This quotation fairly represents the general tone of all the reports on this point. College graduates who are teachers of experience are effective in teaching theoretical mathematics; but in order to present the subject of applied mathematics effectively much actual shop experience is essential. This thought was well expressed in one of the papers by the director of the industrial classes in Fitchburg, Mass., in recommending preparation in the "best possible technical schools with 5 or 10 years' shop experience as apprentice or journeyman." But, ideal as such preparation may be, it will be recognized as a very difficult thing to accomplish in any large way. Certainly the number of teachers of mathematics, even in practical schools, who have received such training must be relatively small. With very few exceptions the answer to the fourth question—viz, What facilities for preparing teachers of mathematics for trade-school work are known to you?—was "None at all."

Passing to the second main point of inquiry—viz, What changes in the present order of preparation for the practical teaching of mathematics are desirable?—the trend of the replies was in favor of extending such scientific and practical training as engineering courses and shop experience can afford. No director of industrial or trade schools seems to feel that special school facilities for preparing teachers of mathematics for trade-school work would be desirable or indeed possible. One director writes that a course in practical mathematics with a view to teaching "should be given in engineering courses in technical colleges," and another says that it seems best that no special facilities to develop teachers of practical mathematics should be provided, but rather that the effort should be made to develop in engineering schools teachers who have a realizing sense of the importance of applied mathematics and who should further perfect themselves for teaching by actual experience in the solution of practical problems as they arise from time to time in actual shopwork.

Finally, this report may be summarized as follows: There are at present no special facilities for training teachers of mathematics for trade schools. Such teachers now find their best preparation, after the necessary theoretical groundwork, in several years of actual experience in applying mathematics to the problems of the shop and drafting room. This practical experience is considered to be of such importance that it does not seem desirable, from the present point of view of those who have had experience in directing trade-school work, to encourage special school training to develop teachers of mathematics for trade schools.

It is only fair to suggest that in some of our normal schools the kind of training which is given in mathematics will do much to equip teachers for work in industrial and trade schools. This is especially true in schools in which much attention is given in the industrial arts. Not infrequently the teacher in training will have the opportunity to teach mathematics to students who are engaged in work in the household and industrial arts, and the demand will be made that problems growing out of their shopwork be used in the mathematics classes. Such training will not, of course, take the place of actual shop experience upon the part of the teacher, but we may expect that students who have had such experience will at least appreciate the need for knowledge of the work done in shops.

To the student of the elementary school curriculum these investigations concerning the type of work demanded in mathematics for special classes of children will be suggestive in the reorganization of the whole curriculum for special groups of children. It is undoubtedly true that in all subjects the tendency has been to provide a uniform course of study which takes little account of the lack of ability on the part of those who quit school and start to work because of the lack of interest in the school program. On the other hand, the school has made little or no provision for children of superior ability. If it is true that the curriculum all along the line needs to be differentiated in at least the last two years of the elementary school course to meet the needs of those who are to go into the industries, it is none the less true that special provision should be made for exceptionally capable children which will result in the saving of time in their preparation for their later work in college or technical schools. This investigation in the teaching of mathematics will, therefore, it seems, not only be significant in giving information to those who plan to organize work in this field, but it will also point the way for a reorganization which is demanded in other subjects.

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PROVISION FOR EXCEPTIONAL CHILDREN IN PUBLIC SCHOOLS

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DEPARTMENT OF THE INTERIOR

WASHINGTON
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[H. Res. 485.]

IN THE HOUSE OF REPRESENTATIVES,
April 4, 1912.

Resolved, That there be printed for the use of the House of Representatives five thousand copies of the United States Bureau of Education Bulletin, nineteen hundred and eleven, Numbered Fourteen, as issued by the United States Bureau of Education, and entitled "Provision for Exceptional Children in Public Schools," and all to be delivered to the superintendent of the document room of the House of Representatives for distribution.

Attest:

SOUTH TRIMBLE, *Clerk.*

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LETTER OF TRANSMITTAL.

Department of the Interior,
Bureau of Education,
Washington, October 2, 1911.

Sir: There are many children in attendance upon the public schools of our country who, for one reason or another, can not work most satisfactorily to themselves or others when classified with the great majority of the children. School authorities have seen for many years that the presence of such children in the regular classes is detrimental to the progress of both the exceptional and the non-exceptional. In the manuscript entitled "Provision for Exceptional Children in Public Schools," herewith transmitted, Supt. J. H. Van Sickle, of Springfield, Mass., Dr. Lightner Witmer, Director of the Psychological Laboratory and Clinic of the University of Pennsylvania, and Dr. Leonard P. Ayres, Associate Director, Department of Child Hygiene, Russell Sage Foundation, have set forth the results of their investigations and their suggestions and recommendations to the public-school workers of our country in regard to the educational care these children need. In addition to the detailed discussions relating thereto, extended information concerning the number of cities in our country attempting to meet the problems suggested is furnished in tabular form. The authors have tentatively classified those children who need this special care in public schools into ten groups. Some enter late and need help to make up their work; others are exceptionally talented and should be allowed to make as rapid progress as consistent with thoroughness; others enter speaking only a foreign language and at first need special and almost exclusive drill in English; still others are slow, backward, or defective in one way or another, but not to such a degree as to require the care of public institutions for the defective classes. It is a valuable piece of work and will be of much help to all who are seeking for more effective and just classification of public-school children.

I accordingly recommend the publication of these results as a bulletin of the Bureau of Education.

Very respectfully,
P. P. Claxton,
Commissioner.

The Secretary of the Interior.

PROVISION FOR EXCEPTIONAL CHILDREN IN PUBLIC SCHOOLS.

CHAPTER I.

THE DISCOVERY OF THE EXCEPTIONAL CHILD.

THE SOCIALIZATION OF PUBLIC-SCHOOL WORK AND THE INDIVIDUALIZATION OF THE CHILD.

The progress of educational work in the last 20 years furnishes an impressive display of social functions assumed by the schools of this and other countries. Medical school inspection, school feeding, school nurses, and special classes for truants, physical defectives, and backward children are all separate evidences of a single movement looking toward the socialization of public-school instruction and involving the public-school authorities in the direct responsibility for most of the child's life and development.

On the one hand, education is becoming socialized and is giving increasing recognition to community interests. On the other hand, it has resulted, in respect to the children, in a greater individualization. Education is primarily concerned with the task of transmitting from one generation to the next the intellectual traditions and the moral standards which have been acquired by the race. The eye of the teacher, therefore, is mainly directed to the subject matter of instruction, or to the code of morals and manners which it is desired to impress upon the child. This is as it should be. All efficient work is accomplished only through concentration of attention and through the direction of effort toward a single result. The public school must never give up as its chief function the teaching and training of children in relatively large groups, by teachers who are impressed with the importance of the subject matter of instruction, and who look upon the class as a fairly homogeneous unit.

Nevertheless, provision must also be made within the modern public school for training many children not as members of a group, but as individual or exceptional children. The social purpose of this kind of individualized educational treatment may be considered the keynote of our American civilization. Children are not born equal, nor can we ever thrust equality upon them; but American education can see to it that every child has a fair opportunity to develop the mental capacities with which it is endowed at birth. The public schools may eliminate in large measure the accidents of social and financial position and the circumstances of the child's individual history as determining factors in its career. Every child should reach adult age with his brains developed to the full measure of their efficiency. This is recommended not merely out of sympathy for the child, but also because the community needs every bit of brain power available, whether this brain power appears in the family of a Pennsylvania miner, a New England farmer, or a Pittsburgh millionaire. Anything less than this spells retarded or arrested development. The highly gifted child can be as much retarded by the circumstances of his life history or by the school system as is the congenitally dull or mentally defective child. This bulletin is conceived as having the purpose of making available some facts and considerations which it is believed should determine the public-school treatment of the exceptional child.

What is normal, even what is supernormal, often fails to arouse attention. The abnormal, the pathological, the deficient, and the defective—these first win the attention of society. Among primitive races this attention is accompanied by feelings of horror, even of terror, and the abnormal are sometimes eliminated by violent means. Next, they are segregated, under the spur of a philanthropic impulse, and are supported in institutions, or they are retained under merely custodial care. This segregation is partly for the benefit of society, and only partly for the purpose of taking care of society's helpless members. It is relatively late in the history of the world that the discovery is made that the training of certain groups of these abnormal or defective social elements presents a problem of scientific and social importance.

INSTITUTIONS OR SCHOOLS FOR THE DEAF AND BLIND.

In the year 1744 a Portuguese Jew named Pereire gave before the Academy of Science at New Rochelle, France, a most dramatic demonstration of the power of the human intellect to solve a problem of special training. He presented before the members of the academy a boy who had been born deaf, and whom he had taught to talk. From that day the world could no longer regard the training of congenitally deaf children as an impossibility, and yet, despite this brilliant solution of a problem in scientific education, the world was slow to recognize the value of Pereire's work, and it was not until the year 1867 that deaf children in the United States were taught by the oral method.

Institutions for the training of deaf children had been established many years before. This type of special school had its origin in the foundation of a school for the deaf by the Abbé de l'Épee in 1771 in

Paris. Inspired by Pereire's example, but unacquainted with Pereire's scientific knowledge and unpenetrated by his educational genius, the Abbé de l'Épee was moved more by the spirit of philanthropy to care for and educate deaf-mutes. Pereire was perhaps too far ahead of his time to impress the world with the importance of his achievement. Moreover, he never inducted others into the secrets of his method, and with the single exception of Heinicke, in Germany, those interested in the training of deaf children failed during almost a century to grasp the physiological and psychological elements of the problem.

The world has now caught up with Pereire, and public education is about to enter into the full enjoyment of the results of his labors and of the labors of many others in this and cognate fields. It behooves all who are interested in the development of all types of special education to see to it that the work which scientific men within the field of education are accomplishing shall be made available to others. The work must be thoroughly grounded upon scientific principles, and scientific workers as well as trainers of exceptional children must be provided with the professional equipment and the physical means to undertake this work satisfactorily.

The successful training of deaf children stimulated an interest in the blind. By the beginning of the nineteenth century an initial attempt to provide for the training of these two classes of defective children had been made by the civilized nations of Europe and America.

REFORM SCHOOLS.

The next group of exceptional children to be provided for were those who stood in danger of growing into an adult life of criminality; in other words, children in need of special moral training. This movement was inspired partly by the general movement for prison reform in England and partly by the work of such men as Pestalozzi, who were keen to recognize the danger to the continental countries arising from the number of destitute, vagrant, and morally neglected children who had been deprived of their natural protectors by the Napoleonic wars.

In the United States, "houses of refuge" began to be established in 1824, and three of them were soon in existence—one in Boston, one in New York, and one in Philadelphia. These institutions were started not as a part of the prison system, but as an experiment in special education. No one can comprehend the history and present status of houses of refuge and other reform schools who fails to recognize that the inspiration for their establishment was exactly the same as that which led in the last decade of the nineteenth century to the founding of parental schools and public day classes for truants and disciplinary cases. The supreme court of Pennsylvania has decided in a well-known case that the house of refuge is not a penal institution, but a school. The children sent to the reform school become the wards of the State until they are 21, not because of the overt act, but because their actions have proved them in need of special oversight and moral training, or else their home environment or their personal characteristics prove them morally endangered.

IDIOCY AND RETARDATION.

The effort to train the group of children variously designated as feeble-minded, imbecile, or idiotic led first to the scientific appreciation of the problem of retardation and to a real understanding, mainly through the work of Seguin, of the problem of special education in relation to arrested or retarded development.

As in most discoveries, accident and misapprehension played a large part in gaining for us a scientific comprehension of "retardation." A little more than a century ago, in the year 1797, a boy apparently about 12 years of age was found running wild, like a beast of the field, through the forests of Aveyron, in the southern part of France. No one ever knew his origin, or where or how he had spent the years between his birth and his discovery. Devoid of the faculty of speech, he showed very few signs of intelligence and made his wants known through the simplest of inarticulate cries. He selected his food by the sense of smell, and what he chose proved him unaccustomed to the dietary of civilization. He drank by lying flat upon the ground and thrusting his mouth beneath the surface of the water. He often walked on all fours, and fighting with his teeth like an animal, he resisted the placing of garments upon his back, and made unremitting efforts to escape. Subjected to confinement and forced to submit to the ways of civilized life, he proved to be fairly tractable.

Brought to Paris he excited the liveliest interest and was presented as an object of scientific curiosity before the French Academy of Science. Pinel, the famous physician of the insane at Bicetre, declared the child idiotic and therefore untrainable. But Itard, a physician of that first institution for the training of deaf-mutes, established at Paris by the Abbé de l'Épee, believed the boy to be merely wild and untaught. He undertook this boy's training, admitting the close resemblance of the boy's condition to idiocy, but believing that he could be restored to the normal mental life of humanity, because of his conclusions as to the "cause and curability of that apparent idiotism." To express Itard's opinion in modern language, the boy in his opinion was not a case of idiocy, but a case of arrested or retarded development, the result of neglect and separation from the normal human environment.

The outcome of Itard's self-assumed task was to prove him doubly in the wrong. The result of his training showed first that the boy was an idiot and secondly that an idiot could be trained. Itard's failure—for he could not restore this boy to normal mental condition—is one of the great successes in the history of education and mental science. Itard himself scarcely recognized the significance of his own success. Interested in the boy as a primitive savage who had been retarded in development because of the absence of the normal human environment, Itard failed to see that this boy, idiot though he was, suffered from an arrest or retardation of development due to physiological causes resident within himself. The discovery that idiocy is retardation was left for Itard's pupil, a physician, psychologist, and educator, Edward Seguin.

On the basis of the accomplishment of Pereire and Itard, Seguin made the deduction that feeble-mindedness is an arrest of mental development necessarily consequent upon the imperfect sense organs and organs of motion with which these children are endowed at birth. He proposed to exercise the imperfect organs so as to develop their functions, as Pereire had previously developed the organs of articulation in deaf-mutes, and to train the functions of the organism so as to develop the imperfect organs. He defines his system as "the adaptation of the principles of physiology through physiological means and instruments to the development of the dynamic, perceptive, reflective, and spontaneous functions of youth."

Seguin began his first experiment in the training of a feeble-minded child in 1837. So successful was this expert physiological education of all the senses that Seguin won for himself, as Itard had before him, the commendation of the Academy of Science. In 1842 he formed the first small class of feeble-minded children, whose training he undertook at the Bicetre.

Seguin's work became a model for the countries of the civilized world. Inspired by his example and assisted by his treatise on idiocy, published in 1846, training schools for feeble-minded children were established first in Massachusetts in 1849, and in the next few years in New York, Pennsylvania, and other States of the Union.

The next contribution to an understanding of the meaning of the word retardation came directly out of school practice. First among civilized nations Germany addressed itself to the task of educating every child, long before this county had even awakened to the fact that many of its prospective citizens were not receiving sufficient school training to cast an intelligent vote. Just as soon as compulsory education laws were partially enforced and a serious effort made to educate every child, it was found that there are children not properly called feeble-minded who are yet incapable of making normal progress in the ordinary day schools. The appreciation of the necessity of providing a special form of training for these backward pupils led to the organization of the first special class in Dresden in 1865.

In this country the compulsory education laws began to be really enforced in a few States about 1890. As a consequence truant schools, disciplinary schools, and schools for backward children came into existence in some States. The idea of establishing day classes and schools for deficient children appears, however, to have been first introduced to American teachers by August Schenck, of Detroit, in 1878, in an address to the American Teachers' Association. Dr. Andrew Rickoff, superintendent of schools for the city of Cleveland, acting on Schenck's suggestion, established two classes in Cleveland, limiting them, however, to disciplinary cases. The second class was established in Chicago in 1892. This is still in existence, and other special classes have been added. New York established its first class in 1895, under the direction of Miss Elizabeth Farrell. Several other classes have since been formed, and in 1905 adequate supervision was first provided through the appointment of Miss Farrell as inspector of ungraded classes. In the same year, or a year later, a school was organized at Waukegan, Ill., by Supt. Hall, designed for backward children of all kinds, those mentally deficient as well as those retarded through lack of educational advantages.

The first city to plan for a complete organization of these classes directly under the city superintendent was Providence, R. I., which formed six classes for truants and disciplinary cases in 1893, and a separate class for backward children in 1896. Springfield, Mass., organized a special class in 1898, under Supt. Balliet. Boston and Philadelphia followed in 1899; Cleveland established four classes in 1905, and Portland, Me., established a class in 1906.

Another movement undoubtedly played an important part in the awakening of the school authorities and general public to the existence of retardation as an educational and social problem. The introduction of medical inspection into the schools, originally for the detection and prevention of contagious and infectious diseases, led to the discovery and treatment of physical defects, which were found to be a powerful factor in retarding the school progress of many children. Medical inspectors and school nurses, and in more recent years social visitors, are appointed in many cities as an integral part of the school system. Without them it would be impossible to realize the purpose for which the schools exist. The medical profession, both in this country and abroad, has made contributions of great value bearing upon the physical causes of arrested and retarded development.

In the course of time the term "retardation" has come to cover types of children hitherto considered normal. Compared with imbeciles and idiots these children are undoubtedly normal, but compared with those children who are passing upward through the grades without meeting serious obstacles to their progress, these children manifest an arrest or retardation of development. In some this is dependent upon internal physiological causes, a defect of the brain or nervous system, even though a minor defect. In others it is due to physical defects, bad eyesight or hearing, which only indirectly albeit seriously affect the normal development of the brain. We have come to recognize retardation as a mental status, not a brain disease or defect as is idiocy. Retardation is a stage of mental development which can only be defined with reference to what we assume to be the regular course of normal development. Any child, the functions of whose brain are not developed up to the normal limit for his age, is suffering from retardation. A status or stage of progress which may be retardation for one child may not be retardation for another. The physiological and psychological age of a child need not correspond to his chronological age. We have come to see that children who stand at the head of a class in school may be more retarded than children who are at the bottom of a class. There are those who contend that the schools give relatively less training to those who are mentally well endowed than they do to the average pupil or to the dullard.

When retardation is thus defined in terms of individual development the necessity clearly arises for the public schools to provide for the highly gifted children as well as for those less fortunate in natural endowment. The question of importance is as to the number of these exceptional children in the schools. Up to the present time school statistics have limited themselves to enumerating the retarded children, using that term to indicate those children who are behind grade for their age. Pedagogical or school retardation follows from the supposition that a child enters upon his first year of school work before he has passed his seventh birthday. If he advances one grade each year he will complete the eight years of the elementary course before he has passed his fifteenth birthday. This establishes a theoretical age limit for each grade, apparently not excessive in its educational requirements; for the child who leaves the elementary schools in his fifteenth year can not complete the high school before his nineteenth year or graduate from college before his twenty-third year. Supt. Bryan, of Camden, N. J., first collated statistics of retardation based upon the enrollment figures of that city for two successive years, 1904–1906. He found in the elementary schools of Camden that 72 per cent of the children exceeded the theoretical age limit; that 47 per cent exceeded the age limit by one year or more; 26 per cent by two years or more; 13 per cent by three years or more; and 5 per cent by four years or more.

It is generally agreed to call a child retarded or backward who exceeds the age limit by two years or more. The discovery of the existence of over-age and retarded children, and the development of the methods of determining their number, is the work of Maxwell, Bryan, Cornman, Falkner, and Ayres. The literature of retardation has rapidly acquired extensive proportions. The working out of the many practical problems which arise in connection with the treatment of backward children will have consequences which will affect every type of child in the public schools.

SPECIAL CLASSES FOR PHYSICAL DEFECTIVES.

In this country and also on the continent of Europe, sporadic efforts have been made in the public schools to care for various classes of physical defectives. In the United States, especially successful efforts have been made to train in public day classes deaf children and blind children. The best day classes for such children have been located in the Middle West, probably because in that locality adequate provision had not been made by the State in the establishment of institutions for their care and training. It would seem as though in the United States the two systems of handling deaf and blind children will be on trial for some years, to determine whether the custodial school or the day school is the more efficient and economical, and also which is the better adapted for the all-round development of the child.

In England and the United States special classes have been organized for crippled children, in many places the children being transported to the schools from their homes. In Baltimore, special classes have been established for epileptic children. The development of preventive medicine, together with the progress of medical school inspection, has led in many localities to the organization of open-air schools and of special schools for children suffering from tuberculosis.

THE GIFTED CHILD.

The problem of the gifted child may be said to have first provoked action when Dr. William T. Harris, as superintendent of the schools of St. Louis, introduced, as long ago as 1872, a plan for making promotion fit different intellectual grades. In many localities the development of a fixed and rather static grading system and promotion system, particularly when promotions were made only at yearly intervals, led to the discovery that many children are kept back unduly, owing to the "lock-step" system. Many efforts have been made toward the solution of this problem—ungraded classes, more rapid promotion through special tutoring and systems of flexible grading, the method of dividing grades up into groups according to intellectual ability, etc. Several cities have made provision for the more rapid progress of gifted pupils by gathering them into centers where, under especially skilled teachers, they pursue a curriculum modified by the early introduction of some of the high-school studies. It is probable that very many men have been induced to see more clearly the necessity of providing for the gifted child, since so much attention has been given to the backward and defective child.

CHAPTER II.

PROPORTIONS OF SCHOOL POPULATIONS COMPOSED OF EXCEPTIONAL CHILDREN.

If all of the children in our public schools could be ranked according to their intellectual abilities, it is probable that a rough classification would group them about as follows:

Talented	4 per cent.
Bright	92 per cent.
Normal	
Slow	
Feeble-minded	4 per cent.

The 4 per cent here designated as feeble-minded may for administrative purposes be divided into two groups. The lower one includes about one-half of 1 per cent of the entire school membership and consists of children of the lowest grade of mentality found in the public schools. They are genuinely mentally deficient, and can not properly be treated in the public schools. They are institution cases, and should be removed to institutions.

Ranking just above these are the remaining 3½ per cent who are feeble-minded but who can be given a certain amount of training in special classes in the public schools. This is not the sort of treatment that they should ideally receive, for few of them can ever become independent members of the community, but it is the sort that they should have if they are to be dealt with at all by the public-school systems as now constituted.

The foregoing statements in regard to this lowest group in the intellectual scale are of necessity based on meager evidence, for the reason that few comprehensive psychological surveys of entire school systems have been conducted. They represent the conclusions arrived at by those who have conducted such investigations as have been made. The best evidence bearing on the problem is to be found in the following reports:

Two Thousand Normal Children Tested by the Binet Scale. The Training School, January, 1911.

The Classification of Clinic Cases. Holmes. Psychological Clinic, April, 1911.

What Can the Public School Do for Subnormal Children? The Training School, September, 1910.

Report of Committee on Special Education. Report of United States Commissioner of Education, 1910, Vol. II, pp. xxi–xxv.

SLOW, BACKWARD, RETARDED, OR LAGGARD CHILDREN.

Ranking above the feeble-minded group comes a much larger class of children, constituting anywhere from 10 to 50 per cent of the entire school membership, made up of those who are not mentally deficient, but who make slow progress through the grades. In point of numbers and importance these children constitute a great, if not our greatest, school problem. They make up about one-third of the total school membership in the average city, and in most localities their numbers are distinctly greater among the boys than among the girls.

These backward children who take more than the normal time to complete the work of each grade are the children who usually spend their entire school lives in the lower grades, and fall out of school permanently without completing even the elementary course. It is this pedagogical retardation among great numbers of children who have no congenital mental defect that is responsible for the school evils known as repetition, retardation, and elimination.

Data concerning the number of these children in different city school systems may be found in a large proportion of all of the numbers of educational periodicals issued during the past four years, and in most of the recent reports of city school superintendents. Summaries of conditions are presented by Ayres in "Laggards in our schools," Chapters IV and VII, and in the Report of the Commissioner of Education, 1910, Vol. II, pp. xxi to xxv.

NORMAL AND BRIGHT CHILDREN.

The largest group is that composed of the normal and bright children who have no great difficulty in completing the work of the grades satisfactorily in about the alloted time. The size of this group in school systems as commonly organized varies from about 40 per cent to about 80 per cent of the entire membership. This wide range of variability does not indicate that the children of different cities are of such varying degrees of mental ability as the figures would seem to show. It merely reflects the fact that in some cities the demands of the school curriculum and the teaching methods are much more nearly in accord with the abilities of the children than they are in others.

TALENTED OR EXCEPTIONALLY BRIGHT CHILDREN.

Quantitative evidence as to the number of exceptionally bright children found in our public schools is even more rare than is such evidence with respect to the feeble-minded.

Such data as are available seem to indicate that about 4 per cent of the entire school membership may fairly be rated as exceptionally bright or talented. Reference has already been made to the report of the testing of 2,000 normal children by the Binet scale, conducted by the New Jersey Training School. This test showed that somewhat more than 4 per cent of the school children were mentally more than one year ahead of their ages. These are the children who are born with exceptional endowments, and go through the public schools with greater than average ability and rapidity.

Another bit of evidence is found in Volume II of the 1910 Report of the Commissioner of Education, in a table printed on page xxiii. This table presents figures from 319 cities, showing that in the average city about 4 per cent of the pupils are one year or more under age for their grades.

Still further evidence is presented by Ayres, in Chapter VII of "Laggards in our schools," where figures are given from different cities showing that the number of children making more than normally rapid progress through the grades ranges from 1 to 5 per cent of the entire membership.

That these unusually able children have been given scant attention in our public schools is shown by the fact that at the present time only five cities are known to have special classes for exceptionally gifted children. These cities are Baltimore, Worcester, Indianapolis, Lincoln, and Rochester.[1]

SUMMARY.

1. In a normal school population about one-half of 1 per cent of the children are genuinely mentally deficient and should be treated in institutions.
2. Ranking above these comes a group of feeble-minded children, constituting about 3½ per cent of the school membership. These children are educable in special classes of public schools, but few of them can become independent members of the community.
3. Ranking above these children comes a larger group of mentally sound, but slow, children. This group constitutes from 10 to 50 per cent of the membership, and in the average city amounts to about 33 per cent. These are normal individuals for whom the present school curriculum and régime are ill adapted. In most cities a majority of them are boys.
4. Ranking above these pupils is the large mass of school children who make substantially normal progress through the grades and some of whom make rapid progress. These constitute from 40 to 80 per cent of the school membership.
5. At the upper end of the scale comes a group of unusually bright or talented children, composing about 4 per cent of the total number. Only five cities have so far organized classes for these supernormal children.

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[1] In answering the questionnaire, a copy of which appears on p. 31, 54 superintendents write "yes" after item No. 14; but it seems quite certain that the great majority of those answering thus regard some form of flexible grading as the special provision meant.

CHAPTER III.

THE CLASSIFICATION OF EXCEPTIONAL CHILDREN.

We assume that this bulletin is addressed to those who are interested primarily in questions relating to the proper treatment of exceptional children rather than in a scientific classification based upon a recognition of the causes of exceptional character in children. The most significant distinction is that between children who can not properly be educated in the public schools and children who can be adequately instructed and trained in day classes. We shall therefore make our primary classification the distinction between institution cases and public-school cases.

It is difficult to state any one basis for the establishment of this classification. There are at least three grounds for this distinction. In the first place, there are children idiotic and imbecile, children morally degenerate and delinquent, children severely crippled or suffering from a disease like epilepsy, whom any superintendent would recognize as being unfit for association with normal children in the grade. Many of these children are the subjects of custodial treatment only, even inside the institution in which they may be segregated.

A second basis for this distinction has reference to the curability or relative permanence of the child's condition. Certain children who are approximately normal in appearance and in mental character are yet hopelessly degenerate. For their own safety and for the safety of the children with whom they may be associated in the public schools, it is desirable that they should be removed from the schools and placed in institutions. Some of them are educable and can perhaps be trained in the public day schools, but it would be undesirable for them to be thus treated. The most dangerous types of moral imbeciles come in this class. These children some competent authority connected with the public-school system should be quick to recognize. Experts should be called in and the school authorities ought to lend their every assistance to obtain legal sanction for the segregation of these children in special institutions, in order that they may not pass their lives among normal children, with the danger of moral contagion and the possibility of propagating their kind.

The third basis for the distinction between an institutional and a public-school case is amenability to treatment in the public schools and institutions. It stands to reason that an institution which controls every hour of a child's existence—sleeping or awake—ought to be able to provide more effective training for difficult cases than can the public schools in day classes. In distinguishing between those cases which should be sent to institutions and those which should not we must take into consideration whether the child requires the kind of work which the public school can not supply in day classes.

A most confusing circumstance arises from the fact that the various types of exceptional children shade off into normal types of children. From children who are slightly slow and dull by nature, there is a steady gradation through children that are only touched with feeble-mindedness to children who are classified in institutions as "high-grade imbeciles," "middle-grade imbeciles," "low-grade imbeciles," "superficial, and profound idiots." Ordinary teachers, superintendents, and casual observers will have no difficulty whatever in excluding idiots and low-grade imbeciles from the public schools. Indeed, it is very rare that children below the grade of middle-grade imbeciles are found in the public schools. The border-land cases, high-grade imbeciles, perhaps even middle-grade imbeciles, will be interpreted very diversely by those who are not familiar with these classes of children. Some teachers and superintendents will think that they have in middle-grade imbeciles very good material to work with in the public schools; whereas expert opinion may advise the removal of such children from public day classes to institutions.

Another circumstance is that many children are what some call *apparently* feeble-minded or imbecile; that is to say, they present all of the features of permanent imbecility excepting that they very rapidly recover or are restored to approximately normal condition under proper physical and mental treatment. Some distinguish these types of children as suffering on the one hand from imbecility and on the other from pseudo-imbecility. We distinguish between them as being permanently feeble-minded or imbecile, and curably retarded in development. Two children may present exactly similar characters and yet one child may, as the result of a year's special training, be restored to the grades and be capable of continuing in the grades and making normal progress; whereas the other child may, after a year's trial, be finally sent to the institution to which he should have been sent without the waste of a year's time.

The expert is more capable of classifying children into these two groups of institutional and public-school cases than is the uninstructed teacher or layman; but there are doubtful cases where even expert opinion is unable to decide. There will, therefore, always be reason for keeping some of these children in special classes, under observation pending a final diagnosis.

We shall now briefly and concisely distinguish between those cases which we regard as institutional and the cases of those whom we regard as susceptible of treatment in special classes. It will be necessary for us to recognize a third group, comprising types of children concerning whose treatment, whether in institutions or in public day classes, there may be diversity of opinion and practice. It must be premised that our treatment is largely experimental and will probably remain so for many years to come. What place institutions for the training of blind, deaf, and other types of exceptional children shall play in the future and especially in those communities which are approaching this problem for the first time, it is impossible for us to say. Modern criticism of institutional life has led to many reforms in institutional procedure. Much objection that can at present be laid against many institutions for children will undoubtedly be set aside in the future as institutions encourage and develop separation into small groups; for example, separate homes or cottages. There can be no doubt that an institution which need not consider per capita cost can provide children with homes and schools of a character which will conserve the whole life of the child. On the other hand, there is a strong tendency toward the unification of all educational institutions and there is little doubt but that the public schools will be held responsible by many communities for the educational treatment of types of children who in the past have been committed to special institutions. For some cases, e. g., persistent truants, disciplinary cases, children suffering from ill health, children who are a heavy economic tax upon their families, and children whose home life negatives completely the influence of the school, the public schools of the future may be required by an awakened community to provide parental schools, where children will be boarded as well as educated, and where the advantages of home training and discipline will be combined with the special class of instruction.

The grouping which we make, therefore, is to be regarded as a tentative or temporary effort, one which we shall feel under no obligation to defend but which we embody in this bulletin for the purpose of assisting in clarifying the thought of those who are professionally interested in the treatment of exceptional children.

I. INSTITUTIONAL CASES.

(To be dismissed from the oversight and care of the public school authorities.)

1. Morally insane children.
2. Violently insane children.
3. Demented children.
4. All feeble-minded children below the grade of middle-grade imbecile. (Barr's classification.)
5. High-grade moral imbeciles.
6. Severe cases of epilepsy.
7. Cases of contagious and infectious diseases. (Some to be dismissed temporarily; some for prolonged periods.)
8. Children helplessly crippled or suffering from revolting physical deformity.

II. CHILDREN FOR SPECIAL CLASSES OR SPECIAL INSTRUCTION IN THE PUBLIC SCHOOLS.

1. Foreign.
2. Late entering.
3. Backward but capable of rapid restoration to normal grade.
4. Dull and feebly gifted.
5. Children requiring vocational training.
6. Children of precocious physical development, especially of precocious sex development.
7. Exceptionally gifted or able children.
8. Children suffering from various physical defects of minor character but interfering with their progress and unfitting them temporarily or permanently for the grades.
9. Speech cases.
10. Social cases; those whose retardation is chiefly due to home conditions calling for the services of a social visitor as well as a special teacher.

III. CHILDREN OF UNCERTAIN CLASSIFICATION. INSTITUTIONAL OR SPECIAL CASES.

1. Blind and semi-blind.
2. Deaf and semi-deaf.
3. Delinquents, including persistent truants.
4. High-grade imbeciles. (Barr's classification.)
5. All feeble-minded children of higher grade than high-grade imbeciles.
6. Crippled children.
7. Children suffering from epilepsy in mild degree or from nervous or other diseases rendering them difficult or improper members of ordinary classes.

CHAPTER IV.

METHODS FOR DETERMINING THE EXTENT AND DEGREE OF RETARDATION IN CITY SCHOOL SYSTEMS.

The term "retarded" is used with increasing uniformity to describe the condition of children who are too old for their grades. It describes but it does not attempt to explain. There are only two reasons why children may be too old for their grades—they may have entered school late or they may have progressed slowly. In either case the term "retarded" is used by educational economists to describe their condition.

THE AGE AND GRADE TABLE.

The quickest and easiest way in which a school superintendent can discover how many retarded children there are in his school system is by means of a table showing how many children there are of each age in each grade in his schools. The table on the following page shows the distribution of children by grades and ages in the schools of Elmira, N. Y., in October, 1910.

It will be noted that there is a heavy broken line running through the table. In the first grade this line divides the figures so as to leave on the left those referring to the children less than 8 years of age and on the right those 8 years old and older. That is, the figures on the left refer to children of normal age and those on the right to over-age children. The line is broken to make a similar division between the figures for the 8 and the 9 year old children in the second grade, between the 9 and the 10 year old ones in the third grade, and so on for all the grades. The criterion used defines a child as of normal age in each grade as follows:

Grade.	Normal age.	Grade.	Normal age.
1................	Under 8 years.	5................	Under 12 years.
2................	Under 9 years.	6................	Under 13 years.
3................	Under 10 years.	7................	Under 14 years.
4................	Under 11 years.	8................	Under 15 years.

This standard for dividing children into normal and over-age groups in each grade has received general acceptance in the past few years and is now in common use in city, State, and National reports.

Referring again to the table, it will be noted that there are three columns at the right-hand end, the first of which gives the total number of children in each grade, the second the number of over-age

ELMIRA, NEW YORK.

Age and grade distribution, October, 1910.

Grade.	Ages.													Total.	Over-age.	Per cent.
	5	6	7	8	9	10	11	12	13	14	15	16	17			
1	144	262	161	61	14	4		2						648	81	12
2		45	164	166	75	20	9	7	1					487	112	23
3		4	49	166	119	69	34	22	8	2				473	135	29
4			2	32	148	159	93	49	23	13	2			521	180	34
5					24	97	109	107	64	41	14	1		457	227	49
6					1	18	87	130	95	58	24	3		416	180	43
7						1	13	82	109	107	48	13	3	376	171	46
8								20	67	97	59	24	6	273	89	30
Total	144	311	376	425	381	368	345	419	367	318	147	41	9	3,651	1,175	32

children, and the third the per cent that these children are of the whole number. At the bottom is a row of totals giving the number of children at each age, the total number of children, and the number and per cent of over-age ones.

Age and grade tables have suddenly come into common use, because superintendents are discovering that they are the most valuable single form of statistical statement used by schoolmen. They are basal to studies of retardation. By their use a superintendent can easily find out how many over-age children there are in his school system, where they are, and who they are.

For purposes of comparison of conditions in successive years or between different cities it is essential that the date of gathering the data and the basis of enumeration be uniform for all the cities. The most satisfactory basis of enumeration is the enrollment on a given date and the best date is probably that adopted by the United States Bureau of Education and the United States Immigration Commission, which is the second Monday in December.

THE METHOD OF LOCATING THE 13-YEAR-OLD CHILDREN.

A still simpler method for comparing conditions in different cities, or in different parts of the same school system, or for the same city in different years is that proposed by Dr. Roland P. Falkner in the Psychological Clinic for January, 1911. This is based on discovering the whereabouts of all of the 13-year-old children in the school system.

For example, reference to the Elmira table for 1910 shows that there were 13-year-old children in all of the grades from the second to the eighth, inclusive. These children have almost reached the limit of the compulsory school period and it is certain that those not within a year or two of graduation will nearly all drop out without completing the course.

In the case in point the 13-year-old children in the sixth and lower grades number 191 out of a total of 367, or 52 per cent. This fact is one significant measure of the efficiency of this school system. It means that 52 per cent of these children are educational misfits. They are wrongly placed in the grades, they hinder the other children, and they make the work of the teacher harder and less effective. Most of them will leave school without completing the course. The method of locating the 13-year-old children is significant because it furnishes a measure of what the school system accomplishes for the children within the period of compulsory education. It is most simple and easily applied. The necessary data can be gathered in most schools in a few hours and to secure them involves no delay and requires no installation of new forms of record keeping.

REPEATERS.

A third simple method for discovering which children are not making satisfactory progress consists in having each teacher report the number of children who are doing the work of their present grades for the second, third, or fourth time. These children are termed repeaters. The principal advantage of the method is that in gathering the data for the report the teachers become interested in the individual cases of the children to an extent which is usually not equaled when they simply report the ages. The great weakness of this method is that it only takes into account the status of the children in their present grades and does not concern itself with the number of times they repeated the work of lower grades. Because of this defect it gives deceptively favorable mass results.

TIME IN SCHOOL, OR THE PROGRESS STANDARD.

The methods so far discussed for determining the extent and degree of retardation in city school systems are all based on different combinations of data, giving the grades and ages of the children, or the time that they have been in their present grades. The method which gives the best and fullest information is one that combines all three of these criteria and tells where the children are in the school course, how old they are, and how long it has taken them to reach their present grades. This method can be used only where the school records include individual cards, giving the school history of each pupil, or where such individual history can be gathered by means of a special investigation.

The following table presents the results of tabulating the individual records of 980 pupils in the fifth grade in 19 New York City schools at the close of the school year 1907–8:

Age and time in school, fifth grade, 19 schools in New York City, 1908.

Years in school.	Ages.										Total.
	9	10	11	12	13	14	15	16	17	18	
2........	....	1	....	1	1	....	....	....	....	....	3
3........	1	8	7	9	1	....	1	....	....	....	27
4........	33	62	22	13	5	....	1	....	....	....	136
5........	9	100	192	81	36	16	....	....	....	....	434
6........	....	12	68	111	42	9	6	....	....	....	248
7........	....	....	9	27	37	19	3	....	....	....	95
8........	....	....	....	3	12	13	2	....	....	....	30
9........	....	....	....	....	....	4	1	....	....	1	6
10........	....	....	....	....	....	1	....	....	....	....	1
Total.	43	183	298	245	134	62	14	....	....	1	980

By referring to the top row of figures, it will be seen that these children varied in age from 9 to 18 years, and reference to the first column shows that they had been in school from 2 to 10 years. There is a heavy vertical line, on the left of which are the figures representing children 11 years old or less, and on the right, those representing children 12 years old or older. As 11 years is the limit of normal age for children in the fifth grade, this leaves on the left-hand side of the line the figures representing all of the normal-age children, and on the right those representing children who are over age. Children who have been in school 5 years or less and are in the fifth grade have made normal or rapid progress. Those who have been in school more than 5 years have made slow progress.

These two groups are divided by the heavy horizontal line. This gives us a table representing the status of all of the fifth-grade children with respect to their ages and their school progress. All of those represented by figures on the right-hand side of the line are above normal age, and all of those represented by figures below the horizontal line have made slow progress. This arrangement enables us to classify our children in four groups, as follows:

Upper left-hand section: 435 children who are of normal age and have made normal progress.

Lower left-hand section: 89 children who are of normal age and have made slow progress.

Upper right-hand section: 165 children who are above normal age and have made normal progress.

Lower right-hand section: 291 children who are over age and have made slow progress.

These data enable the school superintendents to classify the children of the grade in the four groups, according to their educational needs, and to find out which of them are over age because they entered school late, and which ones are over age because they have made slow progress. The children represented by the figures in the upper left-hand section constitute 44 per cent of the entire grade membership. They are of normal age, and they have been making normal progress. They are not subjects for specialized attention.

The 89 children represented by the figures in the lower left-hand section constitute 9 per cent of the grade membership. They are of normal age, and have made slow progress; and the only reason that they are not numbered among the over-age children is that they were very young when they entered school. Their cases are not yet serious, but they should be carefully watched.

The 165 children represented by the figures in the upper right-hand section are above the normal age, and have made normal progress. That is to say, they entered school late, and the school is not to blame for their being over age at present. Nevertheless, as they are relatively mature, they should be given special opportunities to make rapid progress. They constitute about 17 per cent of total membership.

The 291 children represented by the figures in the lower right-hand section constitute 30 per cent of the grade membership, and are both over age and have made slow progress. These are the serious cases, and they should be given the most careful consideration. They are genuinely backward, and are not only too old for their grades but are chronic repeaters.

The foregoing analysis shows with sufficient clearness the advantages of this form of table. It gives all of the information furnished by the other methods, and much in addition. The disadvantages connected with its use are, first, that the data can not be gathered until the individual school history of each child is secured, and, second, a separate table has to be made for each grade. It is impossible to construct one showing conditions in the entire school system. Moreover, where semiannual promotions are in force, such a table should be extended so as to show both ages and time in school by half years.

A METHOD FOR DISCOVERING THE CAUSES OF RETARDATION.

Children who make slow progress do so because they fail of promotion. Hence the most direct way to discover the causes of retardation is to find out the salient differences between the promoted and the nonpromoted children.

The easiest way to do this is to record significant facts regarding all of the pupils at the close of the school term or year, and tabulate them for the promoted and the nonpromoted pupils, so as to discover in what respects conditions in the first group differ from those in the second group. This avoids the common error which results from gathering data concerning solely the pupils who fail, and then having no way to determine how these pupils differ from the successful ones. A blank form, which has been successfully used for gathering significant data for promoted and nonpromoted pupils, is the following:

Records of promoted and nonpromoted pupils.

	Number among children promoted at end of year.	Number among children not promoted.
Boys	———	———
Girls	———	———
Average age	———	———
Average days attended	———	———
From non-English-speaking families	———	———
Foreign born	———	———
Suffering from malnutrition	———	———
Mentally defective	———	———
Defective vision	———	———
Defective hearing	———	———
Adenoids	———	———
Other throat troubles	———	———
Enlarged glands	———	———
Defective teeth	———	———
Other defects	———	———

Grade———. School———. Teacher———. Date———.

In a recent investigation the use of this blank showed that nonpromotions were much more frequent among boys than among girls, and that attendance was much poorer among the nonpromoted than among the promoted children The average age of the nonpromoted children was greater than that of the promoted ones, more of them came from non-English-speaking families, and more of them were foreign born. The nonpromoted children showed much higher percentages of physical defectiveness.

The use of this blank enables the superintendent or principal to rate the different retarding influences in the order of their importance, and as a consequence to take measures looking toward their elimination.

SUMMARY.

The age and grade table tells how many and what proportion of the pupils are too old for the grades they are in. It furnishes the quickest and easiest means for discovering conditions throughout a school system.

The method of locating the 13-year-old children shows what the school has accomplished for the children up to the limit of its legal control over them. It furnishes an indicator of the results of retardation, but does not give a survey of the whole system. It is the most easily applied of all the measures of retardation.

The enumeration of the repeaters in each grade shows which children need special attention at any time. It is easily done, but it does not show which children are chronically backward and which are temporarily or accidentally so.

The age and time-in-school table furnishes the most complete and useful information about the children. It shows which children are over age because they have made slow progress and which ones are over age because they entered school late. It furnishes the best method for discovering the significant facts about the school progress of the children, but it can only be used where individual school histories can be obtained.

The causes of retardation can best be discovered through investigating the differences between the promoted and the nonpromoted pupils.

CHAPTER V.

PROVISION FOR EXCEPTIONAL CHILDREN IN CITY SCHOOL SYSTEMS.

Under date of March 15, 1911, an inquiry was addressed to the superintendents of city schools throughout the United States, asking them for information as to what was being done in their systems to provide for the needs of exceptional children. The inquiry form used was as follows:

WASHINGTON, D. C., *March 29, 1911.*

DEAR SIR: Will you kindly answer the following questions and return this sheet to me at once for the use of a committee which is preparing for the Bureau of Education a bulletin on *Provision for Exceptional Children in the Public Schools?*

Have special classes been formed in your city under the following or other names (answer yes or no)?

1. Delinquent..
2. Backward..
3. Defective..
4. Blind or semiblind..
5. Deaf or semideaf..
6. Open air..
7. For foreigners—day schools..
8. For foreigners—evening schools..
9. Vocational..
10. "Continuation"..
11. Parental or residential..
12. Epileptic..

13 For late-entering children..

14. For gifted children..

Under other names:

15. ....
16. ....
17. ....
18. ....

Have you any provision for:

1. Medical inspection for contagious and infectious diseases............
2. Physical examination for defects..
3. Dental clinics..

Any reports or documents you may have and any rules, regulations, or by-laws adopted by your board of education with reference to such special features of your school work will be greatly appreciated.

Yours, respectfully,

——— ———,
Commissioner.

Name, ——— ———.
City, ——— ———.

The number of these questionnaires sent out was 1,285, and the list to which they were sent includes all of the municipal school systems regularly organized under superintendents. Eight hundred and ninety-eight replies were received, divided among the five State divisions as follows:

North Atlantic	370
South Atlantic	60
South Central	90
North Central	322
Western	56
Total	898

For the purpose of interpreting the results, the answers have been divided into four groups, and the information treated as referring to provision made for children who are exceptional (1) morally, (2) mentally, (3) physically, and (4) environmentally. The different kinds of special provision offered in city school systems have been roughly grouped under these four headings as follows:

I. Morally exceptional:
  (*a*) Classes for delinquent, incorrigible, and refractory pupils.
  (*b*) Parental and residential schools.
II. Mentally exceptional:
  (*a*) Classes for backward children, including help through special teachers, etc.
  (*b*) Classes for mentally defective children, epileptics, etc.
  (*c*) Classes for exceptionally gifted children.
III. Physically exceptional:
  (*a*) Classes for blind or semiblind.
  (*b*) Classes for deaf or semideaf.
  (*c*) Classes for dumb.
  (*d*) Classes for stammerers, stutterers, and lispers.
  (*e*) Open-air classes for children physically subnormal.
  (*f*) Classes for crippled children.
IV. Environmentally exceptional:
  (*a*) Classes for non-English-speaking children, in either day or evening schools.
  (*b*) Classes for children who enter late.
  (*c*) Classes for children from subnormal homes.

PROVISION FOR THE MORALLY EXCEPTIONAL.

According to the returns, 152 cities are making special provision for morally exceptional children. The following table shows the distribution of these cities by State divisions, and by the kind of provision made. The identity of these cities, as well as that of those from which the data of all the following text tables have been secured, may be learned by consulting the tabular presentation of the appendix, which gives by States and individual cities the information secured through the questionnaire.

Cities making provision for morally exceptional children.

Division.	Cities having classes for the delinquent, incorrigible, and refractory.	Cities having parental and residential schools.	Total.
North Atlantic	59	10	69
South Atlantic	7	1	8
South Central	10	1	11
North Central	39	5	44
Western	13	7	20
Total	128	24	152

Comparison of these figures with those giving the total number of cities in each division furnishing the data shows that 17 per cent of the school systems make provision for morally exceptional children. There is noteworthy variation in the percentages for the different divisions, as the following figures show:

Percentage of cities making provision for morally exceptional children.

North Atlantic	19
South Atlantic	13
South Central	12
North Central	14
Western	36
United States	17

PROVISION FOR THE MENTALLY EXCEPTIONAL.

The school systems making provision for the mentally exceptional number 373, or 42 per cent of the total number. The following table shows how these cities are distributed by divisions, and the different sorts of provision made:

Cities making provision for the mentally exceptional.

Division.	Having classes for mentally defective.	Having classes for backward children.	Having classes for exceptionally gifted.	Total.
North Atlantic	44	97	22	163
South Atlantic	3	15	2	20
South Central	7	18	3	28
North Central	32	70	19	121
Western	13	20	8	41
Total	99	220	54	373

In this table the figures giving the number of cities having classes for the mentally defective include the cases in which the superintendents reported classes for epileptics. In a similar way the figures for classes for backward children include the cases in which the reports state that special teachers are employed to assist the slow pupils.

The question as to provision for gifted children has been given a particularly liberal interpretation by the superintendents of the 54 cities reporting such classes. In most cases this means merely that in these cities plans of flexible grading are in force which permit the unusually able pupil to make more than normally rapid progress through the grades.

The percentage figures showing the proportion of cities in each division making provision for the mentally exceptional children show, as in the former case, remarkable variability, and again the States of the Western division make the best record.

Percentage of cities making provision for the mentally exceptional.

Division.	Having classes for mentally defective.	Having classes for backward children.	Having classes for exceptionally gifted.	Total.
North Atlantic	12	26	6	44
South Atlantic	5	25	3	33
South Central	8	20	3	31
North Central	10	22	6	38
Western	23	36	14	73
United States	11	25	6	42

PROVISION FOR THE PHYSICALLY EXCEPTIONAL.

The cities making provision for the physically exceptional number 91, and the kinds of special classes maintained fall into six groups. In the following table the caption "Blind" includes classes for semiblind, "Deaf" includes classes for semideaf, and "Stammerers" includes classes for stutterers and lispers.

Cities making provision for the physically exceptional.

Division.	Classes for blind.	Classes for deaf.	Classes for dumb.	Classes for stammerers.	Open-air classes.	Classes for crippled.	Total.
North Atlantic	4	6	....	1	12	1	24
South Atlantic	....	....	....	....	1	....	1
South Central	....	....	....	....	1	....	1
North Central	9	34	....	1	9	2	55
Western	1	6	1	....	2	....	10
Total	14	46	1	2	25	3	91

One noteworthy feature of this showing is the large number of cities in the North Central division having classes for the deaf and the comparatively small numbers in the other divisions. Another is the small number of cities in the Southern divisions having special provision for the physically exceptional.

The percentage figures show that in this type of provision, as in the preceding ones, the Western division makes the best showing. Six per cent of the cities in the North Atlantic group have provision for the physically exceptional. In the two southern groups the numbers are too low to make it possible to compute the percentages. The figures for the North Central and Western divisions are 17 and 18 per cent, respectively.

These figures giving the facts as to the different numbers of cities making provision for the needs of the physically exceptional do not include the regular work of medical inspection. Figures concerning this were gathered, however, and with the following results:

Cities having systems of medical inspection.

Division.	Having medical inspection.	Having examination for physical defects.	Having dental clinics.
North Atlantic	239	231	54
South Atlantic	28	22	9
South Central	48	31	6
North Central	174	130	44
Western	37	30	12
Total	526	444	125

PROVISION FOR THE ENVIRONMENTALLY EXCEPTIONAL.

The number of cities making provision for the pupils who are environmentally exceptional is 346, but this figure is somewhat misleading for the reason that it includes the data for cities having instruction for non-English-speaking pupils in evening schools as well as in day schools. The facts by divisions are as follows:

Cities making provision for the environmentally exceptional.

Division.	Non-English speaking (day).	Non-English speaking (evening).	Late entering.	Exceptional.	Total.
North Atlantic	41	122	26		189
South Atlantic	1	4	6	1	12
South Central	4	8	7		19
North Central	16	53	27		96
Western	11	10	9		30
Total	73	197	75	1	346

Despite the fact that the cities of the Eastern States having large foreign populations have in many cases provision for the teaching of non-English-speaking pupils, the Western division makes the best showing in this as in all other comparisons. The comparative percentage figures are as follows:

Percentage of cities making provision for the environmentally exceptional.

North Atlantic	51
South Atlantic	20
South Central	21
North Central	29
Western	54
United States	39

CHAPTER VI.

GRADING AND PROMOTION

WITH SPECIAL REFERENCE TO THE NEEDS OF EXCEPTIONAL CHILDREN.

The administration of graded schools has long been based on the plan that at stated intervals, usually of one year, a reclassification of pupils takes place, the more proficient ones being promoted into the next higher grade, and those who have failed to cover the required ground staying where they are. In extreme cases, very backward pupils are "demoted" into the grade below.

The most obvious defect of this plan, which is still in force in many localities, is that the child who fails in one or more subjects, but who has been successful in the rest, is compelled to do again the work of the grade, and to repeat work which he has already successfully completed, as well as that in which he has failed.

The first step toward mitigating the bad effects of this process lies in the system of half-yearly promotions by which the pupil who fails has only to repeat half a year's work, instead of that of an entire year. There is little doubt as to the desirability of this plan. It is in successful operation in scores of cities, and is rapidly spreading.

Many other plans have been designed to introduce flexibility of grading. Most of these are modifications of a plan developed more than 30 years ago by Dr. W. T. Harris, at that time superintendent of schools of St. Louis. The object of this plan was to make such a modification in the promotion system as to retain the machinery of organizations by grades and regular promotions, and at the same time provide for the needs of the exceptionally bright and the exceptionally slow child.

The most thorough and extensive study of the various grading and promotion plans that has appeared in print is that presented by the Brooklyn Teachers' Association in their report printed in the fall of 1910. This investigation is based on the returns from a questionnaire that was filled in by more than a thousand school superintendents, principals, normal school pupils, and so on.

The investigation was conducted by a committee on school organization under the joint chairmanship of Messrs. Van Evrie Kilpatrick and Charles S. Hartwell. As this report constitutes by far the most general and authoritative statement of the opinions and experience of American educators concerning different grading and promotion plans, it is used as the basis for the present summary.

Well-recognized plans for securing flexibility in grading are at least a score in number. Most of them are known by the names of the places in which they have been used. For example, the Cambridge plan is one that has been used for some 20 years in Cambridge, Mass., and the Batavia plan has long been followed in Batavia, N. Y. In many other instances, while plans are known by the names of towns or cities, they have in point of fact never been in universal use in those localities.

Nearly all of these numerous plans fall into one or the other of two groups. In the first group are devices for securing, so far as possible, uniform progress through the grades on the part of all pupils. These plans depend on giving special instruction to the dull pupils in order that they may be enabled to keep up, or in giving extra work to the bright pupils in order that they may cover more than the normal amount of work outlined for each grade. These two modifications of the plan for securing uniform progress are typically represented by the Batavia and the North Denver plans.

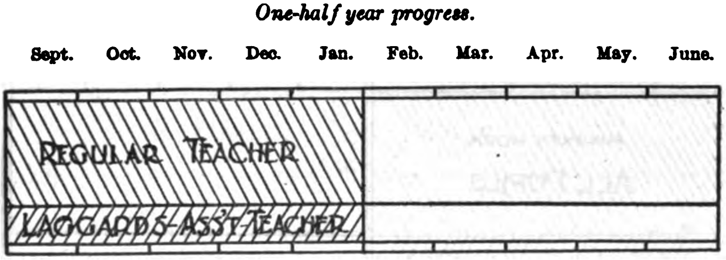

FIG. 1.—BATAVIA PLAN.—The diagram illustrates the equal progress of all the children in a given grade during one term. The coaching of the slow pupils by the assistant teacher makes this equality of progress possible.

In the second group are grading and promotion plans which are based on the idea of permitting children of differing abilities to complete the work of the grades in differing lengths of time. The Cambridge and Chicago, or "large city" plans are typical of those which provide for differing rates of progress among different classes, while the Pueblo plan is based on the idea of letting each individual child go forward according to his particular abilities and without reference to those of the other children.

THE BATAVIA PLAN.

The Batavia plan has for many years been used in the public schools of Batavia, N. Y. In its inception it was a device resorted to in order to make tolerable the use of very large schoolrooms provided through the faulty design of one of the school buildings.

The chief characteristics of the plan are large classes with additional teachers to give individual instruction to the backward pupils in each room. The progress of all the pupils is uniform, this uniformity being secured through the individual teaching of the slow pupils.

The principal objection to the plan is the one inherent in all attempts to teach classes of very large size. As a temporary relief for conditions brought about by overcrowded schoolrooms, the plan is probably good, but it is not to be commended for permanent use under normal conditions. Among the reports received by the Brooklyn Teachers' Association from 973 educators, only 138 had tried the Batavia plan, and of these only 62 per cent favored it after trial.

THE NORTH DENVER PLAN.

The salient characteristic of the Batavia plan is that under it the best efforts of the teaching force are devoted to assisting the least hopeful members of the class. The interests of the ablest are sacrificed to those of the dullest. In sharp contrast to this is the North Denver plan. The object of the plan is to provide an opportunity for the brighter children to do more extended, more intensive, and more individual work than the other members of the class. This extra work is done by them during free periods, while the other children are reciting. Home work is minimized and the brighter pupils are trained to depend less and less on their teachers and given an opportunity to push ahead as rapidly as their capacities will permit.

One-half year progress.

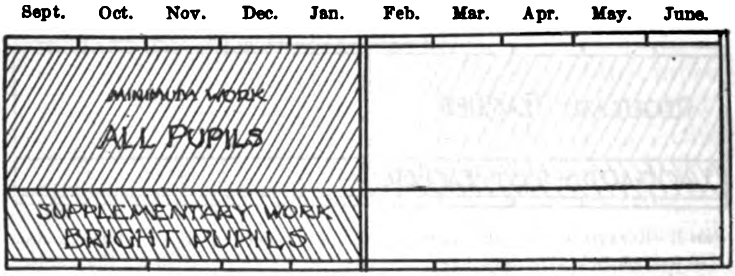

FIG. 2.—NORTH DENVER PLAN.—Diagram illustrates how equality of progress is secured through giving the bright pupils supplementary work, instead of giving the laggard pupils extra teaching.

Among the 973 educators who contributed to the study of the Brooklyn Teachers' Association, 169 had tried the North Denver plan, and of these 94 per cent favored it after trial. The chief virtue of the plan is that it places its greatest emphasis on assisting the brightest pupils. Its object is predominantly constructive rather than predominantly remedial.

THE CAMBRIDGE PLAN.

The plan long in use in the schools of Cambridge, Mass., is the best known of the different devices and systems for securing an opportunity for children of differing abilities to progress through the grades at different rates of speed. Its aim is to classify students according to ability and then to have the different classes or divisions go forward at rates appropriate to their varying abilities. Moreover, it brings the pupils of the different classes together at stated intervals and provides for reclassification. The mechanism of this plan is shown in the diagram, which illustrates how provision is made whereby a pupil may complete the work of the six grammar grades in four, five, or six years and is given opportunity to change from the slow to the fast division or vice versa.

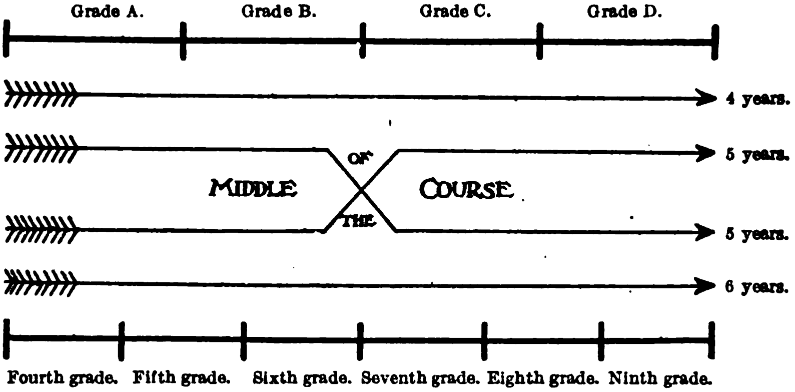

FIG. 3.—CAMBRIDGE PLAN.

Seventy-five of the 973 educators had tried the Cambridge plan, and 92 per cent of them favored it after trial.

LARGE-SCHOOL PLAN.

In New York, Chicago, and other cities a plan commonly known as the "large-school plan" has been in use for 15 years or more. The large number of pupils makes it possible to have three or more classes in each grade and the plan places the brightest ones in one class, the medium ones in other classes, and the slow pupils in still other classes. Each class completes the grade work as rapidly as possible so that the bright division may be promoted a month or two before the slow one. The chief virtue of this plan is that it makes possible close grading and the most just placing of each individual pupil. Its chief defect is that it is applicable only to large schools. Of the 973 educators above referred to, 111 had tried the "Chicago plan," which is virtually the large-school plan, and 93 per cent of them favored it after trial.

THE PUEBLO PLAN.

The most individualistic plan of grading and promotion that has ever been advanced is known as the "Pueblo plan." This plan provides that each pupil shall advance as rapidly as he can accomplish his work. The individual and not the class is the unit in study, recitation, progress, and graduation. If groups are formed for recitation they are temporary. The teacher is a director of work, going from pupil to pupil. There is no home study. Among the 973 educators questioned, 207 had tried the Pueblo plan and 96 per cent favored it after trial. The chief objection against it seems to be that it is so intensely individualistic in nature that it can only be successfully carried out when teachers of unusual ability are available and they remain in their positions for considerable periods of time.

One-half year progress.

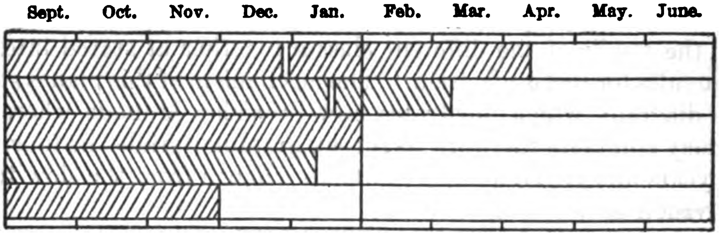

FIG. 4.—LARGE SCHOOL PLAN.—During the half year to which the diagram refers the brightest pupils (in the division represented at the top of the diagram) have completed the work of a term and a half. Each of the other divisions has covered less ground, the last one, at the bottom, having done little more than half a term's work.

One-half year progress.

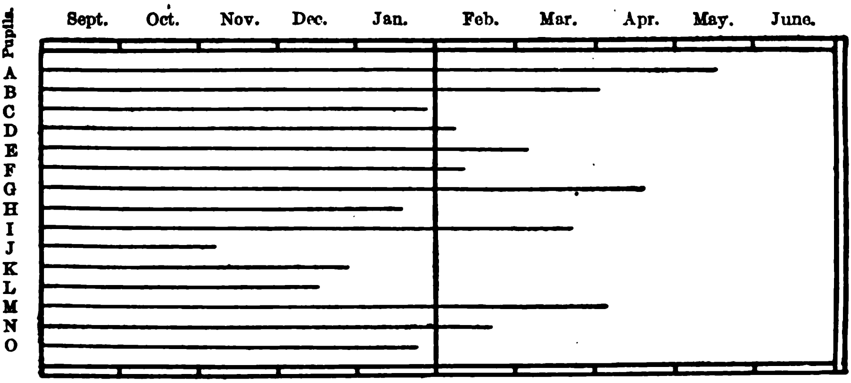

FIG. 5.—PUEBLO PLAN.—Each horizontal line represents the progress of an individual pupil, and their varying lengths show how pupil A has covered almost a year's work during the half year, while the slowest pupil (J) has done only about a quarter of a year's work.

SUMMARY.

The first unquestionably valid conclusion which comes from a study of the various plans designed to secure flexible grading and promotion is that the "lock-step" system is prejudicial to the interests of the pupils. In this method of mass promotion, the individual is lost. Under it pupils are not so classified that the work given may be adapted to their individual abilities. It places the emphasis on the weak instead of on the strong, and so makes it difficult to shorten the elementary school period for the more able pupils.

There is no simple, ready-made plan for avoiding the evils of the lock-step system, and securing for each child that full opportunity to advance according to his individual ability that is the goal of the ideal school system. Every plan must be modified to meet local conditions. In many cities several modifications, and even several different plans, are needed.

There is general consensus of opinion that the object of a grading and promotion plan should be to bring together children of similar abilities and like capacity for carrying the work, so that each group shall be as nearly as possible homogeneous. Frequent opportunity should be provided for reclassification, so as to allow for changes in the ability of the child to carry the work, giving children who have been making slow progress opportunity to go forward rapidly, and, where necessary, those that have been making rapid progress opportunity to go forward more slowly.

The emphasis of the system, and the strength and efforts of the teachers, should be primarily devoted to assisting the bright pupils, rather than directed toward forcing forward the dull ones.

CHAPTER VII.

DESCRIPTIONS OF WORK DONE FOR EXCEPTIONAL CHILDREN IN AMERICAN SCHOOL SYSTEMS.

(Extracts and Summaries from Letters and Reports Sent by Superintendents.)

BALTIMORE, MD.

Classes for epileptics—Disciplinary classes—Parental schools.—Two special classes are maintained for educable epileptics. They attend school during the forenoon only. Car tickets are furnished for those living at a distance from the school. Twenty-four ungraded classes, chiefly for disciplinary cases, are maintained—one for each group of schools presided over by a single principal. These two forms of special classes are provided primarily for the relief of the regular classes. There is also a parental school for habitual truants.

Flexible grading.—The plan of grading in operation in the larger schools includes the grouping of children of the various grades into fast, medium, and slow classes. The fast classes are relatively large. The medium and slow classes are graded down in numbers as well as in ability in order that the teaching may be more and more individual as the slowest divisions are reached. The slowest are treated as special classes with the curriculum modified to fit individual needs.

Classes for gifted.—On completing the work of the sixth grade especially capable children, whose parents desire to have them do so, are allowed to take up extra studies of high-school grade, earning thereby credits which count toward the high-school diploma. Such children are able as a rule to complete the work of the seventh and eighth grades and the four high-school grades in five years.

Individual assistance.—Individual assistance is given to children who are backward in one or more studies by senior students in the training schools, who perform this service as a part of their course in the practice of teaching. They render valuable service, for which they receive a small compensation, and are benefited by the corrective effect of this individual work upon their natural inclination toward teaching the lesson rather than the child.

Dental clinic.—A dental clinic has been established in the parental school. The Society for Oral Hygiene has provided the equipment and the volunteer service. All pupils of the school have had their mouths examined and their teeth repaired. New pupils are treated as soon as possible after they are committed to the school. Thus far the school board has been called upon only to provide a suitable room.

BAYONNE, N. J.

Disciplinary classes.—A special class is maintained for refractory boys. One of the immediate effects sought in the organization of this class was to relieve the regular classes of the presence of these pupils. Another was to cause a large number of pupils who were giving trouble to do better. Transfers are made in such a way that a boy is given a second trial in a regular class before entering the special class. Thus it is necessary to send only a small per cent of troublesome pupils into the class.

BOSTON, MASS.

Classes for subnormal.—Several special classes for subnormal children have been maintained. A special medical expert examines the children who are recommended by the principals for admission to these classes. Only improvable cases are accepted. Specially trained teachers are employed in these classes, and the number of pupils is limited in each class to 15. The course of study is exceedingly flexible, and is especially full of motor-training elements. Many pupils have been returned to the regular grades. Many others who have made small progress in the acquiring of knowledge have, however, established moral habits and acquired physical control sufficient to make them eventually self-supporting members of the community.

Disciplinary classes.—Two disciplinary classes have been established under charge of teachers especially qualified for this work. No more than 20 pupils are assigned to each teacher. With scarcely an exception, pupils whose school work and behavior under ordinary conditions have been valueless to themselves and detrimental to their classmates have become, in the disciplinary classes, interested in their work, and therefore obedient and punctual.

Ungraded classes.—In each district at least one ungraded class is authorized. In some districts, where a large number of immigrant children are learning to speak English, several such classes are conducted. These classes differ from regular classes primarily only in the fact that a smaller number of pupils are assigned to them (35). The instruction necessarily must be adapted to the conditions in the class, and the course of study is modified to suit these conditions. The purpose is to give special help to those pupils who need it and to return them as soon as possible to the regular grades.

Vacation school.—In the summer high school opportunity is given to secure additional points or to supplement the work of the regular school sufficiently to enable the pupil to secure a passing mark. By this means pupils of exceptional ability may be able to shorten their high-school course by a year, and pupils who have failed to pass some part of their work during the year may make it up in the summer and thus graduate in four years instead of five.

Examination for defects.—Thirty-four school nurses are constantly employed in finding and correcting all forms of physical defects. The entire department of school hygiene is giving its attention to improving the health of the children. Every pupil is examined each year by the teachers for defects of eyesight and hearing.

Open-air classes.—In January, 1909, the park commission granted the school committee the use of two rooms and the roof of the refectory building in Franklin Park, and an outdoor class was started there on January 18, 1909. No pupil who has reached a contagious condition is admitted. A careful medical examination of each child is made by an expert every second week.

The schoolhouse commission has been requested to provide some of the new buildings with fresh-air rooms, so arranged that the heat may be shut off and the room filled with fresh outside air and flooded with sunlight. In these rooms pupils who would benefit from more fresh air may be seated with slight additional administrative difficulty and with no additional cost.

To wait until fresh-air rooms in new buildings are supplied in every district would postpone the benefits of fresh-air instruction for many generations. Much can, however, be done under the present conditions. An experiment conducted during the present year by the principal of the Prescott School illustrates the possibilities in any school. "With the advice and assistance of the school physician and the school nurse about 20 children who were thin, pale, anæmic, and repeatedly absent, were seated during pleasant weather in a cozy corner of the school yard, with portable desks, and under the charge of a special assistant. The regular work of the classroom was carried on in this outdoor class. This arrangement relieved the most crowded rooms and worked a most phenomenal change in the condition of the children who are in this fresh-air class."

CALUMET, MICH.

Ungraded classes.--Three "grading rooms" are maintained to take care of pupils who are more advanced in some subjects than in others. Ten or twelve pupils are placed in each room under a strong teacher. Some subnormal pupils are included in these classes.

CAMBRIDGE, MASS.

Open-air classes.—The open-air school is conducted in a dwelling house, remodeled and equipped for the purpose. The school will accommodate 27 pupils. During the first three months pupils were received on the recommendation of examining physicians of the Anti-Tuberculosis Association. Later, however, the pupils have been admitted on the recommendation of the medical inspectors of the schools and the visiting nurse, and they are returned to their regular classes when their physical improvement, as shown by a careful examination, is such as to lead the inspector and nurse to advise this action. The improvement in the general health of the children as indicated by complexion, appearance of the eyes, increase in strength and activity, has been noticeable. On entering the school each child is provided with a chair bag, a leg blanket, a soapstone foot warmer, a worsted toque, a pair of woolen gloves, and an outside coat. With this equipment the children are comfortable even in the severest weather.

CAMDEN, N. J.

Classes for subnormal.—The first special class established was somewhat experimental in character. Pupils were grouped about square tables the height of which is determined by the size of the children. Parents have consented to medical examination and treatment.

Operations have been performed by the hospital surgeons upon seven children, by a physician in his office upon two others, and four other children have received careful and continued medical treatment. All of those in the school during the last year have been given painstaking medical attention. In several instances, the treatment begun under the advice of the teacher has been continued by the physician at the request of the parents.

There are now four special classes for mentally deficient children, two others for average children whose mental condition is not strong, one distinctly disciplinary class, and two classes of institutional children, many of whom must be regarded as special.

CHICAGO, ILL.

Schools for crippled.—Crippled children are taught in two schools, to which they are transported free. Ten busses are used.

Parental schools.—The average membership in the Chicago Parental School in 1910 was 297, and the average period of detention six and a half months. The minimum term is a little less than four months. The time of parole is determined by the boys' behavior and the quality of work, outside pressure being disregarded. Boys are encouraged to earn their parole as quickly as possible, to guard against the danger of being institutionalized and to make room for others on the waiting list.

After a boy has shown his capacity to do good work and to behave himself in the parental school, he is paroled to his home school. After parole he is carefully watched, and if necessary is visited by his teacher or family officer. Reports are sent to the parental school once a month by the principal, showing the boy's deportment and progress in his studies. If these reports continue good for the period of one year, the boy is recommended to the board of education for discharge from the custody of the parental school. During the period of parole, the boy may be returned upon the order of the superintendent of the parental school, for violation of the terms of his parole. About 18 per cent of the boys are returned; the remainder make a record from fair to excellent in their home schools.

Correction of speech defects.—Children with speech defects, stammerers and stutterers, are given special corrective exercises by members of the graduating class of Chicago Teachers' College trained for their particular work in the department of oral expression. Instead of gathering the children together into one building, the young teacher travels from school to school.

Cases of adenoid growths and of other difficulties in the speech organs needing surgical or medical attention are referred to the department of child study.

Psychological clinic.—The department of child study examines all subnormal children, and prescribes the kind of intellectual and physical training which the teacher in the subnormal center shall give the child. A program is furnished the teacher in each case by the department. The promotions to the grades are made after the examination by the department of child study. The membership in each subnormal center is limited to 20.

Classes for deaf.—In the classes for the deaf some attempts were made during the year 1910 to bring the deaf pupils more into contact with the hearing pupils in recitations and exercises than had been the custom. Deaf pupils were taken into classes of hearing pupils for construction work wherever possible. The absence of part of the class of deaf pupils from the special room enabled the teacher to devote her time exclusively to the remainder of the class; while the deaf pupils working with their hands along with the hearing pupils found their infirmity no bar to efficient work. Deaf pupils were sent to rooms of hearing children regularly or occasionally for recitations along with hearing pupils, the lessons having been prepared with the help of the special teacher. They usually returned from such exercises full of enthusiasm and eager to tell of the new things learned. While they gained little and gave to the teacher but little when compared with the hearing children, it was much for them, and they profited by it.

Instead of the department of child study spending time in making so large a number of examinations as formerly at school buildings—and that without much of the necessary apparatus and appliances—many more remote and widely separated sections of the city were served by appointments to meet the examiners at the offices of the board of education. Furthermore, by getting into direct communication with the parents or guardians who accompany the child to the office, suggestive information can be secured relative to the child's home, personal history, and in general the group of factors which influence unfavorably his progress in school work. All this, when found necessary, is supplemented by the subsequent report of the school nurse or social worker after having visited the home.

FROM "OPEN-AIR CRUSADERS," 1911.[1]

Open-air classes.—In September two rooms were opened in the Graham School to show what natural cold air will do for normal pupils. No selection of individuals was made except that as children entered the school for their first year's work they were given their choice of entering a cold room or a warm one. Of course some pains were taken to inform the parents in advance as to what it was expected the cold air would do. After several weeks of trial in which zero weather was encountered and no bad effects followed, teachers, parents, and pupils, seeing what had been done for those in the two rooms, asked for rooms in the other grades for the same sort of work. The school year closed with seven open-air rooms.

So satisfactory was the work that the school opened in September with 20 cold rooms, merely retaining enough of the warm-air rooms to insure a place in a warm room in every grade for pupils whose parents desired them to have it and also a place for teachers to work in warm air in case some of them feared that work in a cold room might prove too strenuous.

The work in a cold room differs from that in a warm room. The pupils are exercised far more frequently and in the low grades the seats are removed so as to provide floor space for games and dancing. Common wooden chairs or kindergarten chairs take the place of seats, and long tables of simple construction replace the old form of rigid desks. The children sit in the schoolroom clad in the clothing which protects them on the way to school. They keep all that clothing on, if they choose, or lay aside their caps, mittens, overshoes, and coats if they feel uncomfortable with them on. During the year no money was paid out for any sort of clothing to protect the children from cold, as it was found that whatever clothing would bring them safely to school was more than enough for protection in the school, where games were frequent.

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[1] *Open-Air Crusaders.*—Sherman C. Kingsley, 1911. Published by United Charities of Chicago. For free distribution.

CINCINNATI, OHIO.

There are day classes for the deaf, for the blind, for foreigners, for the mentally defective, and for the retarded. The instruction of the blind is so carried on that the blind children have considerable association with other children. The mentally defective children are brought together in a convenient center, so that there can be some classification and much attention to manual work. Those distant from the center are conveyed to the school at the expense of the board.

School for backward.—A special school is maintained for slow children more than three years behind normal children of their age, but not mentally defective. In organizing this school a careful physical and mental examination was made of the children and their homes were visited. Such as needed medical attention received it. Glasses were provided and operations performed for adenoids. A truant officer reports each morning to look up absentees. The following advantages are claimed: All the causes usually assigned for backwardness are found to hold good here, but especially it has been found that the children had gotten out of harmony with school work and most of them were in school because they had been coerced by parents or school officers. On the street and in their games they were able to play their part, but in the schoolroom they had been grouped with children who, though much younger, surpassed them.

Now that they have been grouped with those of their own age, and work is assigned them that interests them, their attitude toward school has changed. They are classified in groups that average from 28 to 30 per teacher; the course of study has been modified to meet their special needs; they are given a great variety of handicraft and a half hour of physical training a day in the gymnasium. Under these conditions the children have become tractable and regular in attendance, and the progress they have made is encouraging to them and to their teachers. It has been demonstrated that under favorable conditions most over-age children not mentally defective can do creditable school work and become serviceable citizens

The great advantage of collecting a large number of special pupils into one school over the old method of establishing an ungraded room in each school is apparent. Classification of groups of children with similar needs enables teachers to handle twice as many children with greater ease; the enthusiasm that comes from numbers is obtained; the teachers themselves have companionship and an opportunity to interchange ideas and get counsel; and, above all, manual and physical training can be given in a systematic way that will lead to usefulness.

These teachers are paid only $50 more than grade teachers. There is an advantage in this, for those who do not feel a genuine interest in such work will not be tempted to go into it because of money consideration. When teachers of special aptitude go into special work, they will not voluntarily leave it. There seems to be a fascination about it; every child is a problem; there is something distinctly interesting each day and hour; there is a continual call for sympathy, energy, skill, and tact; there is a feeling of unity and harmony and mutual helpfulness in the teaching corps; and, finally, there is the sense of mastery and the exultation of victory over the unusual. This seems to apply to the teachers in all types of schools for special children.

Special school for boys.—Pupils are sent to this school by the juvenile court or by the superintendent. It includes boys who are willfully and persistently absent from school and those whose conduct, while not criminal, is not amenable to ordinary treatment. The school is the last resort in school discipline. To a decided extent it has removed the necessity for corporal punishment. The number of cases of corporal punishment now is not one-half what it was five years ago. It is now restricted by stringent rules and can be administered only in presence of a third person.

The superintendent commits boys only to the day school. If this proves insufficient to break up truancy, the juvenile court commits to the detention department, where the pupil is kept at night, attending the school (in the same building) by day. Of those who were removed to other institutions only three were for truancy; that is, the school failed in only three cases. Almost all who have remained under its influence for some time have completely changed their ideas and their attitude toward organized authority. Most of them have gone out and lived up to their expressed intention to "make good."

Sixty per cent of those in attendance have been committed for truancy, 40 per cent for incorrigibility and other causes. About 60 per cent have been committed by the superintendent of schools and 40 per cent by the juvenile court.

All are given one hour in the shop, one hour in the gymnasium, and three hours in the schoolroom where emphasis is given to the commercial side of the essential branches and to drawing and writing. Most of the work is individual.

The discipline is so free as to create some criticism. There is a spirit of good will, however, that could not be obtained by a spying, cruel system of government. The teachers insist upon gentlemanly behavior and try to secure it from properly cultivated motives rather than from forms and rules. The school is very popular with the boys who do not want to be sent back to their own schools. Parents frequently report that the boys behave much better and show more willingness to help. The purpose of the school is not punitive; it is to develop in the boys the power of self-government and a desire for self-control.

CLEVELAND, OHIO.

Ungraded classes.—Whenever a child, because of low mentality, bad home influence, nervousness, physical defects, or any other cause, falls behind, he is left with his regular grade and sent to the school for backward children in the study or studies in which he may need special help. These schoolrooms for backward children are not complete in themselves, but rooms to which those needing it are sent for special assistance.

Flexible grading.—Where conditions are favorable, schools are arranged into slow and fast grades. The differences in children are great, and to have the children of widely varying capacities in the same class is to the disadvantage of all, and especially to the disadvantage of the less capable. This is true even when the teacher seeks to give special attention to the slower pupils, for the stronger will invariably assume the leadership, and this tends to restrain and suppress the weaker. To organize schools where the conditions are favorable into slow and fast grades is then merely to place children of relatively equal capacity together. To equalize opportunities, 45 children are placed in the fast, and only 35 are assigned the slow grade.

The advantages of this plan for the strong children are: Instruction can be better adapted to their capacities; a broader range of facts can be considered, and a wider range given to the application of principles; instruction can be made more thorough and fundamental. On the other hand, the less favored children can be given work better suited to their abilities; the advance is slower and more carefully planned; there is greater opportunity to develop individuality and leadership, and to bring out whatever ability and latent capacity these children may have.

This plan or organization thus permits each to work according to his capacity, and while it adds to the strong, by making the slower grade somewhat smaller, it permits not only of a better adjustment of work to the less favored, but also of a greater amount of personal attention, and can not help being a factor in holding many a slow child in school and up to grade.

Vacation schools.—Vacation schools, open to all children of grammar and high school grades who have failed of promotion, are maintained for eight weeks in the summer. Responsibility for promotion of the pupil after having done this work is vested in the vacation teachers.

School for backward.—A new 20-room building in the center of a very congested district has been set apart for retarded children. There are 800 children in this school retarded one, two, three, or more years. It is planned to simplify the course of study and to give the work of this school a strong individual bias, to the end that part of these retarded children may make up certain of the time lost and be restored to their proper grade, and that the others may be advanced along lines suited to their abilities and thereby secure more of an education than would otherwise be possible to such children.

DENVER, COLO.

School for backward.—Two buildings have been set apart to which are sent children who are three years or more behind their grades. The demand is in excess of the capacity of these two buildings. The pupils enrolled are studied as individuals and every effort made to ascertain why time has been lost and how the difficulty may be overcome in each case. Other centers for retarded children are to be provided.

DETROIT, MICH.

Classes for deaf.—Forty-nine pupils were registered in the school for the deaf in 1909. A number of semideaf children were transferred to the deaf school at so early an age that much may be done to retain and develop speech.

In January, 1908, three pupils completed the eighth grade and were graduated. Two are attending the Central High School, where they follow the course of study prescribed for their hearing companions without special help. The third pupil, because of adverse circumstances, was compelled to assist in the support of the home. She is employed in the mail-order department of a large dry-goods store in this city. In January, 1909, a former graduate of the school for the deaf completed a high-school course. The success of these pupils has been a great incentive to the pupils of the grammar grades who are now planning for a high-school education. Detroit maintains a normal training department in connection with the school for the deaf.

FITCHBURG, MASS.

Special teacher for backward.—After several years' experience with the type of ungraded class in which children backward in one or more branches took all their work in the ungraded rooms, a change was made to a plan by which the child engages in general exercises in one of the regular grades, and comes to the special teacher about 20 minutes each day for special help in the troublesome study. This teacher has no other children to watch, no other work to supervise. The special weakness of each child is considered, and the work planned accordingly. At least twice the number of children reached by the former plan can be reached by this plan. Fifty different children a day has been the highest number, 40 to 45 being the usual number.

Supplementary classes.—Pupils of the highest grammar grades, commonly known as "left overs," many of them having been "left over" in previous years, are allowed to enter the high schools, forming a class by themselves, a single teacher being placed in charge of the whole work of the class, who lays out work for the pupils according to their individual capabilities. These pupils are able to pursue some of the studies of the high-school grade, although advancing less rapidly than the members of the other classes.

Provision is made in like manner for pupils from the various classes next below the highest grammar grade, these pupils standing in relation to the highest grammar grades in a position corresponding to that which those "left overs" from the highest grammar grades stood in relation to the high school. These pupils from the various grammar schools are united in one class and made a part of the highest grade in a way similar to that under which the special high-school class is organized and managed. Some members of the special high-school classes are able to do the work prescribed for the regular classes and some admitted to the supplementary grammar grade class make such progress as to gain admission to the high school with the regular class.

HARTFORD, CONN.

Open-air class.—The first outdoor school in Connecticut was opened in a tent on the grounds of the Sigourney School, on January 3, 1910. A floor was laid with a sand cushion beneath it and a wainscoting built about the sides of the tent to about 20 inches, affording protection to the feet of the pupils, all the air in the tent coming in from the upturned sides and not from the damp ground. The arrangement of the tent inside was like that of the regular schoolroom, with desks, blackboards, and other paraphernalia. Two teachers of experience in different grades of work were engaged to care for the school, and were eminently successful.

Through the cooperation of the Society for the Prevention of Tuberculosis, food, warm clothing, and medical examination and inspection were provided.

The children were selected from 13 different schools and from 10 different nationalities and numbered 47 before the season closed. When children had gained sufficiently, or home conditions had materially improved, children were sent home, at first, but later it seemed best to retain them as long as possible, in order to test not only the health-giving scheme of the school but the educational side as well.

All school children entering were selected from groups selected from schools and examined. They were first weighed, and thereafter tested on the scales weekly and a record kept of their weight at each weighing. Some of the records show remarkable gain, while others show steady upward progress.

The temperature in the tent has registered as low as 16° while the studies were in progress and no one seemed to suffer, protection to the feet being assured by heated soapstones in the sitting bag.

Most of the pupils were below grade in their studies. Under ideal conditions—small numbers, perfectly fresh air, nourishing food, rest, and exercise—they made much progress. One second-grade child who was in the outdoor school less than two months, upon her return to the regular school was put into the fourth grade. There were nine grades in the school. One teacher taught the first five grades; the other took the four remaining grades. When possible the classes were united. The backward pupils were greatly helped by reciting with several classes. Children who were poor in a certain branch were put into two or three classes of that branch. A child who was particularly good in a study was allowed to recite that branch with a higher grade. In every way the children were encouraged and not held back.

The children wanted to work, and to work hard, and wished to keep abreast in their studies with the children of the other schools. While they were unable to work hard in the other schools on account of ill health, they could do so in the outdoor school, where they improved rapidly in health, and where they studied under such favorable conditions.

HOUSTON, TEX.

Ungraded classes.—A special room is set aside for "exceptional pupils." To this room are sent pupils who are not capable of learning in the ordinary class room, and yet who are not so deficient as to need to be committed to a State institution.

Many of them are physically defective. While in this room they have special medical care and attention. It has often happened that as soon as the child has received proper medical treatment he is able to go back into the regular room.

Such subjects as manual training and school gardening are especially emphasized. If a child can do good work in some one subject, as, for instance, reading, but not in others, an effort is made to allow him to progress as rapidly as possible in the subject which he can learn easily, and yet to lay enough stress on the other subjects. In some instances the pupil takes work on one subject with the normal children of a regular grade room, and takes work on another subject in this special class.

INDIANAPOLIS, IND.

Classes for gifted.—For the particularly able, special classes are formed at the beginning of the seventh grade, in which two years' work is accomplished in a year and a half. The relation between the lower school and the high school is such that strong work in the last year and a half or last two years in the grammar grades secures a half year's credit in the high school. These and other children may by exceptionally strong work in the high schools save another half year.

For children strong in mathematics and language, classes are formed at the beginning of the eighth grade, in which Latin and algebra are taken in addition to the regular work of the grammar school. Time for this work is provided for by diminishing the time for English and arithmetic. Strong work in these classes secures a half year's credit in the high school in Latin and algebra, and other credits may be secured by good work in other subjects to make up about two-thirds of a term's high-school work.

Special teacher for backward.—For children who are slow at their studies and need more help than the regular school-teacher can give, a special teacher is provided in about eight schools in the city where the need is greatest. This teacher helps during the term from 50 to 75 different children. These children are almost exclusively in grades two to five, inclusive.

Ungraded classes.—For children who are are on the border line of the mentally defective, at schools where there is a sufficient number of them to warrant it (in grades two to five, inclusive), a special room is set apart with a special teacher. The teacher's task in these schools is to study carefully the individual, to help where she can to put the child on his school feet, and restore him to the regular schoolroom, if possible. The book work is given so far as the child can follow it, but manual occupations of various kinds are also introduced, and an effort is made to establish habits of self-control, etc.

School for backward.—For the decidedly mentally defective children, two schools have been established on opposite sides of the city. Specially trained teachers have been placed in charge of these schools. Membership is not allowed to exceed 16 pupils each. The work that is commonly pursued by schools of this character is pursued there—manual occupations, habit-forming exercises, and such book work as can be given.

Disciplinary classes.—For confirmed truant and delinquent boys a special school is provided. Here manual training is emphasized, and special standards of discipline are maintained.

Industrial.—In certain districts of the city, in the seventh and eighth grades conducted under the departmental plan of instruction, from one-third to one-half of the time for both girls and boys is given to industrial work. The regular book work occupies the balance of the time. The pupils hold as high standard as they ever have held in their book work, although they are giving considerably less time to it. This kind of specialization will be extended from two schools the current year to three schools next year. Several other districts in the city would like to have it introduced as fast as the authorities see their way to doing it.

The expense for this kind of instruction is approximately $6 a pupil more than the exclusively book-work plan.

The general plan of development of this kind of work involves adapting the industrial phases of the work to the life of the community in which the school exists; therefore the lines of activity are different in different schools.

JOPLIN, MO.

Individual assistance.—Teachers of first-grade classes dismiss all pupils less than 7 years of age at 11 and 3 o'clock, and spend the remaining time working with the older pupils. Teachers of second-grade classes dismiss all pupils under 8 years of age at quarter past 11 and quarter past 3, and devote the remaining time to the older pupils. This work with the older pupils is not on the regular lessons, but on back work or such irregular work as will bring up retarded pupils or help others on to the next higher grade. Above the second grade the work with retarded pupils is done mostly by pupil teachers who devote one-third of their time to this work.

Special rooms, superior as to light and ventilation, are set aside for the physically defective. Weaklings are kept in cool rooms and given special exercises conducive to health.

LINCOLN, NEBR.

Classes for gifted.—Provision is made for unusually gifted children by placing them in a special room after the completion of the sixth grade. In this school during two years they complete the work of the elementary school and also the first year of high-school work.

A plan is being worked out whereby the dull and deficient children will receive proper attention.

LOS ANGELES, CAL.

Ungraded classes—Parental schools—Classes for deaf and dumb.—Special classes include the following: Ungraded rooms open to all elementary school children who are at a disadvantage in the grades; special ungraded rooms open to truants and incorrigibles; foreign ungraded rooms for the newly arrived immigrants; a detention house and parental republic at the service of the juvenile court; one trade class, giving work in carpentry, sewing, and cooking, the pupils devoting half a day to the study of books and half a day to industrial training; two classes for deaf and dumb, taught by oral method; and one day nursery. This last is housed in a building furnished by the school department and standing on ground furnished by the school department, but in all other respects it is in charge of the Parent-Teacher Association of the city. It takes the babies of poor people and takes care of them during the school day. It is located in a Russian settlement where poverty compels the parents to go out to work. The school law compels the older children to go to school. This would leave the baby at home or else compel an older child to bring the baby to school. Out of necessity has grown the above-mentioned day nursery.

LYNN, MASS.

Individual assistance.—In all of the larger graded schools special teachers are employed who work with backward pupils and also with exceptionally capable pupils. There are special classes for foreign children. In these classes are found children of all ages who are just learning the rudiments of English.

MILWAUKEE, WIS.

Classes for the blind.—In each of 3 schools, situated in 3 different sections of the city, a room is set aside for the use of the blind pupils, who come in charge of parents or guides, on the street cars, or otherwise, as their parents arrange. Those who live long distances from the school usually come in charge of a brother or a sister or a little friend of school age, who accompanies the blind child as a regular pupil, and who usually enters the school in which the class for blind children is taught.

The blind children gather first in the room specially provided for them; they then go to the regular schoolrooms, where they remain during the opening exercises of the classes to which they belong. After the opening they return to the special room to study their lessons. At recitation time in any class the blind children who belong to that class go from their special room to the regular class room and there take part in the lesson as the seeing children do. They use the same textbooks, which are printed for them in point letters (American Braille being the point system used), reading or spelling or solving the question in arithmetic in their turn. After the recitation is completed the blind pupils return to the special room and there do their studying under the oversight of the special teacher for the blind. One of these has charge of each of the rooms and acts as helper and special teacher.

The number of pupils which the teacher of such a group can care for properly is from six to eight, this depending somewhat on the age of the children and on other considerations.

These schools are under the direct management of the board of school directors, according to the provisions of an act passed by the Wisconsin Legislature. This act authorizes the establishment of day classes for the blind in connection with the public schools of cities and provides that for each pupil in average daily attendance in such cases the State shall pay to the school board maintaining such a school the sum of $200 per year. This sum is to be used for defraying the expenses of instruction, including salaries of teachers, cost of books and materials for manual training and other lessons, and to pay car fare for children who live long distances from the school. It is also used to cover the cost of instruction in some industrial employment or in music, according to the aptitudes of the different pupils.

Classes for subnormal.—A class for exceptional children has been used as an experiment station to ascertain in just what way it is practicable to deal with children who are somewhat subnormal intellectually, and to establish rules for guidance in deciding what children can profitably be instructed in classes of this kind. Early provision will be made for the entire 300 or more now in the schools.

Ungraded classes—Non-English speaking.—There are 12 ungraded classes. They are primarily classes of opportunity. They are not designed for dull or stupid or unruly or subnormal pupils; they are intended chiefly for children who are considerably above the age of the classes in which they are found and who should have given to them some opportunity to make up the lost ground and to get into a class with children of their own age and general attainments. These classes are much used for young foreigners who do not have a knowledge of English; for boys and girls who come in from other schools or from other cities, and whose teaching has been of a different kind, so that they do not fit into the regular grades of the schools; for boys and girls who have been out of school or who have had poor educational advantages and so are two or three or four years behind the grade in which they should be.

The ungraded classes are used to some extent also for apparently average pupils who have not been able to get along in the regular classes. These children, when put into the ungraded classes, are put there chiefly in order that they may be studied, and that the teacher and the principal may be able to decide what is the cause of the pupil's backwardness.

MINNEAPOLIS, MINN.

Stammerers.—A school for stammerers, undertaken by a competent teacher for two months, was so successful that the board engaged the teacher for an additional term of two months to instruct another set of pupils. The superintendent recommends the continuance of the work.

Ungraded school.—An ungraded school, centrally located, in 1910 received 191 pupils from 43 different schools. A pupil sent to the ungraded school is required to remain at least one month before he can be transferred to one of the regular buildings.

NEWARK, N. J.

Ungraded classes.—Several ungraded classes have been maintained, in which those children are enrolled who, through chronic truancy or persistent misconduct, are not considered fit to remain in the regular grades. For the better accommodation and training of these children two buildings are to be erected on opposite sides of the city. Each building is to contain, besides the principal's office, two class rooms suitable for the accommodation of 25 pupils each, a gymnasium, shop, and shower baths. A kitchen and proper dining-room facilities will also be provided. The sites will be spacious enough, it is hoped, for playgrounds and for school gardens.

Both these buildings are expected to be models of their kind and such as to afford the boys who attend these schools all the facilities needed for a rational training. The shop and the gymnasium features are believed to be needed to train the boys in useful habits of industry and in health and soundness of body. The kitchen feature is intended chiefly to enable the teachers in charge of the school to keep the boys on the premises during the noon intermission. Lacking this feature, it has been found necessary to allow the boys to go on the street in the noon hour, which has often resulted in their engaging in mischief or in making themselves a nuisance to the residents of the vicinity. It is thought that their retention at the school during the whole school day will serve to strengthen the habits of good behavior that the school seeks to attain as one of its main ends. Again, their retention at the school during the noon hour will afford an opportunity at lunch and in the recreation period on the playgrounds to teach lessons of appropriate social behavior which boys of this kind generally lack. Manliness of conduct, fair play, cooperation, consideration for the rights of others, sympathy, kindness, etc., are important social and civic habits which need specially to be emphasized in a school of this kind.

Schools for feeble-minded children, for the blind, for the deaf, for the crippled, and open-air classes for anemic children are planned.

NEW BEDFORD, MASS.

Ungraded classes.—Ungraded classes, started as an experiment, have become a fixed part of our organization. While these classes are planned for illiterates and the course of study followed is such as will enable the pupils to meet the legal requirements for a work certificate, many pupils have been transferred to the regular grades and have done good work. One boy, who entered one of these classes three years ago, is now in the freshman class at the high school.

NEW HAVEN, CONN.

Disciplinary classes.—Rooms are set apart for two classes of children, viz, the refractory and non-English speaking. The rooms for the refractory are in the hands of men teachers, and each room has from 15 to 25 pupils. At present the chief value of these rooms is said to be that refractory children are removed from other schools.

Non-English speaking.—Non-English-speaking children are taken into special rooms as soon as they reach the city. The ages of the children vary from 5 or 6 to 13 or 14. The number constantly varies on account of the irregularity with which they reach the city and also the necessary irregularity with which they are promoted to grade rooms.

NEWTON, MASS.

Ungraded classes.—Special classes are maintained for backward and peculiar children, and unassigned teachers work with individuals in the regular classes who need special attention.

NEW YORK, N. Y.

In New York, when a case of truancy or incorrigibility develops, the usual method of procedure is as follows: The boy is suspended by the principal, after giving him many warnings and trials under different teachers. Official notice is sent to the parent and to the district superintendent. Parent and child are summoned to appear before the district superintendent. If upon investigation it is evident that the parent is to blame, warning is given the parent that the next offense will result in a summons to the magistrate's office and consequent fine. Whether parent or boy be in fault the boy is, if possible, transferred to another school, the principal of which is informed of all the circumstances in order that he may place the young offender where he will receive proper watching and care. The boy is also required to present at the district superintendent's office every Saturday a parole card giving a record of his daily attendance and conduct.

Parental schools.—In the vast majority of cases this procedure is effective. If it fails, parent and child are again summoned to the district superintendent's office and previous threats of commitment to the parental school are carried out. The accommodations at the parental schools are not proportionate to the school population. For this reason a special disciplinary school is provided. The same course of study is followed as in the regular schools, with the exception that greater emphasis is placed upon physical training and manual training. The school is large enough to permit the same grading that is followed in other schools. There are more than 100 special classes for mental defectives and 23 classes for crippled children. For these the board of education furnishes rooms and teachers. Nurses, luncheons, medical treatment, and transportation are furnished through private philanthropy.

Classes for the deaf and the blind.—There is a school for the deaf, with an attendance of 160 children. Blind children are taught in the regular classes with seeing children. Car tickets are provided for each child and his attendant when the distance from his home to the school is considerable. A teacher from the regular force gives her time to the blind children attending a given school, but after the children have acquired some proficiency in the use of the Braille slate and Braille typewriter they are sent to the regular graded classes. Books, maps, and charts in raised type are provided by the school authorities.

Open-air schools.—Day camps or open-air schools have been provided on abandoned ferryboats and elsewhere for tuberculous and anemic children, the school board providing teachers, books, and supplies.

Non-English speaking.—Classes for non-English-speaking children accommodate about 1,200 children. About 1,500 are cared for in classes for the mentally defective, and twice as many in classes for children who will shortly reach the limit of the compulsory-attendance period and are preparing to take their work certificates. More than 20,000 slow children are cared for in so-called "Rapid progress classes," in which they are given the advantages of skilled teachers and abridged and amended courses of study.

OAKLAND, CAL.

Classes for deaf.—Special classes are maintained for the deaf and for those who fail to keep up in the grade work. Saturday morning classes are maintained for those who are not able to attend school during the entire week. In connection with medical inspection, free clinics have been provided for the benefit of those children whose parents are not able to contribute full pay for services rendered.

PHILADELPHIA, PA.

School for backward.—The first special school for the truant and incorrigible was established in this city in 1898. The number of such schools has grown to 9 at present date. The first class for backward children in a regular school was established in 1901. The number of such classes has grown to 6, and one school of 6 classes has been organized as a special school for backward and mentally deficient children only. With but two exceptions the special schools, though originally intended for the truant and incorrigible only, have by a natural classification of the pupils attending them been organized for backward and mentally deficient children also. The schools, however, are small, varying in size from but 2 to a maximum of 7 classes, and make provisions for only 1,000 pupils. There are in all 23 disciplinary classes with an enrollment of 458 boys, and 25 backward classes (6 of these are in regular schools) with an enrollment of 350 boys and 107 girls.

READING, PA.

Disciplinary class.—Two schools, one for pupils physically and the other for pupils socially not fitted to the grades, are now in operation. Since their opening in the spring of 1907, 60 boys and girls have been enrolled in the former and 111 in the latter. The results have been gratifying. Of the 111 that failed to attend punctually in the grades, 48 are now regularly employed, 23 have been returned to the grades, 13 have been transferred to other institutions, 7 have removed from the city, 1 has died, and 19 are now in the special school. The effect of this school has been felt upon the entire pupil body. Since its establishment the number of suspensions has decreased 75 per cent, and chronic truancy has lessened 80 per cent. In fact, truancy now reported is confined almost entirely to half-day and day cases.

ROCHESTER, N. Y.

Classes for subnormal and for gifted.—There are 16 classes for subnormal children in different sections of the city. The work of one supervisor and one medical inspector is limited to this department. Non-English-speaking children and delinquent children are grouped in a similar manner. Capable children in the eighth grade earn high-school credits in civics, English, algebra, Latin, and German. Seven teachers devote their time to pupils who are deficient in reading, arithmetic, and English.

ST. LOUIS, MO.

School for backward.—Two classes of exceptional children receive special attention—the deaf and the extremely backward. Children incapable of doing either the kind or amount of work that slow children of normal intellect can do are brought together in small two-story houses rented for the purpose. Transportation is furnished to those children whose homes are not within walking distance. Each house accommodates two classes of 15 children each. There are two teachers in each center, and a woman attendant who lives in the building and takes care of the heating and cleaning.

SALT LAKE CITY, UTAH.

Psychological clinic.—A class for subnormal children has been planned which will serve quite as much the purpose of a laboratory for the study of such children as a place for their instruction. A teacher of experience, a university graduate with special training, will have charge, and will secure the cooperation of the department of psychology and the department of medicine of the State University.

SCHENECTADY, N. Y.

Non-English speaking.—Foreign-born children are taught in separate classes until they acquire a working knowledge of English, when they are regraded according to their proficiency in other subjects.

The number of children who are over age for their grades is determined annually. Where physical defects are found, the child is placed under the care of the board of health. Where no physical defects are found the child's progress is hastened by placing him under a special teacher who gives her time to backward pupils.

SOMERVILLE, MASS.

Dental clinic.—In addition to a class for children of less than normal mental power and an ungraded class in which children remain a few weeks to make up deficiencies, a dental clinic has been organized through the voluntary services of 25 dentists who give their services without charge to the city for the treatment of school children who could not otherwise have the treatment. While the results are gratifying, it is probable that it will be necessary for the school board to cooperate in some elements of expense if the undertaking is to be made permanent and thoroughly satisfactory.

SPOKANE, WASH.

Parental schools.—A parental school is maintained, occupying a farm of 40 acres, 5 miles from the city. The board of school directors bought the land, cleared it, erected for the accommodation of 25 boys a cottage containing dormitories, kitchen, dining room, laundry, attendance rooms, library, manual-training rooms, lavatories, etc. They also provided for a schoolhouse, detached barns, chicken houses, ice house, reservoir, electric-light plant, irrigation system, wells, etc.

The boys have a teacher for the regular school work, and, in addition to this, receive instruction in woodwork, gardening, and horticulture.

A fine stream traverses the property, affording facilities for swimming, boating, irrigation, and ice supply.

The boys are committed by the superior court on recommendation of the attendance department of the public schools.

The life on the farm in almost every case works a complete transformation of the boys, because it puts them in proper environment and gives them the right interests.

Though in operation but one year (1910) the school is crowded. More cottages will be added very soon.

Ungraded classes.—In the city there is an ungraded class of boys living at home who do not fit into the regular school organization. These boys receive individual instruction to a large extent and considerable manual training. It is planned to give a still greater proportion of shopwork to these boys.

The results of this class have been most encouraging because the boys have been given new interest where before they had none.

The establishment of a school for subnormal and other defective children is contemplated.

SPRINGFIELD, MASS.

Ungraded classes.—Five rooms are set apart for children who are backward in one or more studies and for children who can not speak English. The enrollment per room is limited to 20 pupils.

Classes for subnormal.—One special class is maintained for mentally defective children. The membership is limited to 14. Low-grade cases are not admitted. The hours of attendance are 5; 3 in the morning and 2 in the afternoon. Car tickets are furnished to those pupils whose homes are not within walking distance. Approximately two-thirds of the day is given to physical, manual, and sense-training work. Kindergarten methods and materials are used for those who need them, and the regular work done in Grades I and II is attempted, viz, reading, writing, spelling, number, drawing, singing, telling of time, story-telling, and dramatization, the emphasis being laid on object teaching and personal experience.

The teacher of this class for defective children has had special training for her work, and she is frequently called upon to examine retarded children in the various schools of the city and to determine, if possible, the reason for their retardation.

Arrangements have been completed for maintaining an open-air school for anemic children on the grounds of a centrally located school building. The enterprise is cooperative, the Association for the Prevention of Tuberculosis furnishing the tent, the extra clothing, the food, and the care, and the school committee supplying the regular school equipment and the instruction.

WILLIAMSPORT, PA.

Flexible grading.—The schools are divided into fast and slow divisions. A particularly slow division is taught as a special class.

Work for physically and mentally defective children is contemplated, but not yet definitely planned.

WOONSOCKET, R. I.

Non-English speaking.—Two classes have been established for the instruction of non-English-speaking children in which 51 children have been enrolled. Thirteen understood practically no English, 10 understood a little, and the others had been in the city schools two or three years, but seem to have made but little progress. Each schoolroom has a map of the United States and the American flag. The books are the same as those used in the evening schools and were prepared especially for non-English-speaking pupils. Objects and pictures are freely used and as the new words are learned the pupils are taught to use them in sentences and responses. Besides reading the pupils have had conversation, dictation, spelling, numbers, map questions, and language work.

Of the seven most advanced, one came direct from France and understood no word of English. Another of those making good progress had come here only a few weeks before entering school.

The children seem to be interested, and most of them learn very rapidly. Many of them go to work as soon as they are 14, and they seem to want to learn as much English as they can before leaving school.

WORCESTER, MASS.

In the reclassification of the special and ungraded classes in the Worcester schools there has been an attempt to classify for the present as follows:

Non-English speaking.—Those of normal ability having a knowledge of subjects in their own language, but who, because foreign born, have not a command of English. Where two classes existed in the same location they have been redivided according to age, separating the older from the younger children. For these the stress is on the English language, ability to read and write it, and the special class is a grading room, whence the pupil soon passes to a regular class. It is a question whether these should be included among the so-called special classes.

Ungraded class.—Children of normal ability but temporarily retarded in one or more subjects by some of the previously mentioned causes. For such the special class is a clearing house, whence they pass to a regular grade.

Class for feeble-minded.—Children slow to understand, of naturally inferior intellectual ability, so constituted nervously as to be unable to profit by mass teaching; their progress slow but steady.

Class for mental defectives.—In addition to these last are those so deficient as to be entirely incapable of profiting by ordinary school methods, yet it is the task of the school to make the most of existing mentality.

Class for the physically defective.—A class of normal children suffering retardation because of some physical defect, such as seriously defective vision or hearing.

Classes for gifted.—In addition to the foregoing, exceptionally capable children are brought together into convenient centers, where they take up extra studies of high-school grade along with those of elementary grade, thus shortening the high-school course.

CHAPTER VIII.

THE SELECTION AND TRAINING OF TEACHERS.

The best advice that can be given to the superintendent of schools who appreciates the necessity of organizing special classes, and who is desirous of introducing them, is to proceed with that he finds nearest to hand. It would be a mistake for him to wait until he has ascertained the whole number of backward or of physically and otherwise exceptional children, and then attempt to introduce a complete organization to meet the needs of all. The number of such children will be found to be much larger than the superintendent has dreamed; the expense will be much greater than the school board will be likely to assume in connection with a new enterprise in education. Moreover, it would be impossible to find anywhere in the United States a sufficient number of adequately trained teachers to meet the needs of the large number of different types of exceptional children.

In one school system it might be desirable to begin with a school for the deaf, in another with a school for crippled children, in another for disciplinary cases—depending upon the immediate and most pressing necessity in each school system. In most communities schools for truants and disciplinary cases have been relatively more firmly established than schools for other types of exceptional children. This is undoubtedly because of the bad effect of these "moral" cases upon class-room discipline.

Our advice would be to organize one class at a time, to organize it with reference to the needs of the children who have been discovered in the school system, and to organize it with some reference to the special teacher who is to have charge of it. The best provision to make for the teaching is to assign some member of the school system, perhaps a teacher of experience in primary work, who has shown an aptitude for the handling of individual cases. There is a difference between class-room instruction and individual teaching. Many admirable class-room teachers, perhaps even the best of them, will not be especially serviceable as teachers of individual cases. The teacher must have her mind on the physical and mental make-up of each child, and her interest must be not in the teaching of school branches but in getting the child to make the next step forward.

The best training of these teachers must come from actual experience. Perhaps as good a plan as any is to select a good teacher, give her a limited number of children, and let her work out her own salvation, for the first year at all events. After she has had some experience with such work, so that she knows her limitations and knows to some extent what she needs, it would be well for her to begin to add to her professional equipment.

The subjects in which she most needs instruction are hygiene, physiology, psychology (with special reference to the various types of defective children), and, so far as these are known, the best methods of conducting the work with different types of children. It is not to be expected that any one teacher can fit herself for work with all classes of children. For example, one teacher may be especially well equipped for articulation work; whereas another teacher may be poorly equipped for this work and yet be very successful with the ordinary backward cases.

Special training should be given to those teachers who are going to do what is, after all, the most important work for exceptional children—the training of those children who have fallen behind their grades, but who are yet capable of catching up. What is needed here is hurry-up work, forcing work; and the teacher requires unusual teaching ability and a special equipment. What is needed for this kind of work is not a knowledge of the methods of training feeble-minded children, but a knowledge of expert methods of encouraging normal mental development.

There is no one institution which offers all of the varied training which a teacher of exceptional children may require. The first training offered for public-school teachers of backward children, so far as we know, was offered by the department of psychology of the University of Pennsylvania, in the year 1897, in the summer-school course. Before this, teachers had been trained for the teaching of deaf children in the public schools, notably in Chicago and Milwaukee. Since then the Vineland (N. J.) Training School for Feeble-minded Children has put its resources at the disposal of the teachers of this country and is doing admirable work. All this and more is needed. The public schools of this country require a training school for teachers where all lines of special work will be adequately represented. Science—many different branches of science—and practice with all the common types of exceptional children must afford highly gifted and well-trained teachers the means of adding to their professional equipment what will make of them "educational experts," who will render service to their communities not only as the teachers of exceptional children but as the advisers of ordinary teachers and administrative officers and as contributors to what has been termed "orthogenics"—the science which deals with the study and treatment of mental and physical defects obstructing and retarding normal development.

Cities reporting but not stating any provision for exceptional children.

Alabama.—Florence, Gadsden, Girard, Huntsville, New Decatur, Selma, Talladega.

Arkansas.—Paragould.

California.—Napa.

Colorado.—Canon City.

Connecticut.—Norwich, Southington.

Florida.—Pensacola, Tampa.

Georgia.—Albany, Americus, Elberton, Rome, Savannah.

Illinois.—Alton, Belleville, Blue Island, Champaign, Charleston, Clinton, Edwardsville, Elgin, Freeport, Galena, Jacksonville, Litchfield, Kankakee, Mendota, Monmouth, Mount Carmel, Normal, Ottawa, Taylorville.

Indiana.—Alexandria, Bedford, Bluffton, Garrett, Gas City, Jeffersonville, Lawrenceburg, Linton, Logansport, Madison, Montpelier, Portland, Rushville, Warsaw.

Iowa.—Albia, Cedar Falls, Crexton, Fort Dodge, Keokuk, Mason City, Missouri Valley, Oelwein, Oskaloosa, Washington.

Kansas.—Arkansas City, Cherryvale, Concordia, Galena, Independence, Rosedale.

Kentucky.—Frankfort, Madisonville.

Louisiana.—Lake Charles, Monroe, Shreveport.

Maine.—Belfast, Gardiner, South Portland.

Maryland.—Salisbury.

Massachusetts.—Blackstone, Middleborough.

Michigan.—Albion, Coldwater, Holland, Ionia, Marshall, Niles, St. Joseph.

Minnesota.—Moorehead.

Mississippi.—Columbus, Corinth, McComb, Meridian, Vicksburg.

Missouri.—Boonville, Independence, Maryville, Rich Hill, Springfield.

Montana.—Anaconda, Helena.

Nebraska.—North Platte.

New Hampshire.—Exeter, Franklin, Keene, Rochester.

New Jersey.—Hackensack.

New York.—Ballston Spa, Bath, Corning, Lyons, Matteawan, Medina, Middletown, Oneida, Ossining, Oswego, Owego, Plattsburg, Potsdam, Seneca Falls, Tonawanda, Waterloo, Wellsville.

North Carolina.—Burlington, Concord.

North Dakota.—Bismarck, Minot.

Ohio.—Alliance, Defiance, Piqua, Troy, Wapakoneta, Washington, Wellsville, Wooster, Xenia.

Oklahoma.—Perry, Shawnee.

Oregon.—Baker.

Pennsylvania.—Ashland, Bloomsburg, Carbondale, Catasauqua, Clearfield, Coatesville, Columbia, Conshohocken, Dickson City, Lock Haven, McKees Rocks, Middletown, Millvale, Northampton, Oil City, Peckville, Pitcairn, Pottsville, Renovo, Rochester, Sharon, Tamaqua, Tarentum, Towanda, Waynesboro, Wilkinsburg.

Rhode Island.—Coventry, North Kingston, Pascoag, Warren, Warwick.

South Carolina.—Chester, Florence, Laurens, Rock Hill.

South Dakota.—Aberdeen.

Tennessee.—Bristol.

Texas.—Beaumont, Corsicana, Ennis, Gainesville, Greenville, Hillsboro, Martin, Palestine, Sherman, Temple, Waxahachie.

Virginia.—Fredericksburg, Suffolk.

Washington.—Bellingham.

West Virginia.—Clarksburg, Wheeling.

Wisconsin.—Baraboo, Waukesha.

Statistical summary of cities making provision for exceptional children.

States.	Number of cities reporting.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners.		Vocational.	Continuation.	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible, refractory.	Dumb.	Home subnormal.	Provision for—		
								Day schools.	Night schools.														Medical inspection.	Physical examination for defects.	Dental clinics.
United States	898	121	207	94	14	46	25	73	197	136	36	24	5	75	54	8	13	2	3	7	1	1	526	444	125
North Atlantic	370	56	90	43	4	6	12	41	122	48	12	10	1	26	22	1	7	1	1	3	......	......	239	231	54
South Atlantic	60	5	14	2	......	......	1	1	4	10	2	1	1	6	2	2	1	......	......	2	......	1	28	22	9
South Central	90	10	18	7	......	......	1	4	8	13	6	1	......	7	3	1	......	......	......	......	......	......	48	31	6
North Central	322	38	66	30	9	34	9	16	53	55	14	5	2	27	19	4	4	1	2	1	......	......	174	130	44
Western	56	12	19	12	1	6	2	11	10	10	2	7	1	9	8	......	1	......	......	1	1	......	37	30	12
NORTH ATLANTIC DIVISION.																									
Maine	17	......	3	1	1	1	......	......	5	1	......	......	......	......	1	......	......	......	......	......	......	......	8	13	3
New Hampshire	12	1	2	......	......	......	1	2	5	2	1	......	......	1	......	......	......	......	......	......	......	......	7	6	2
Vermont	8	2	2	1	......	......	......	......	2	2	1	......	......	1	1	......	......	......	......	......	......	......	4	7	1
Massachusetts	103	8	28	13	......	2	2	11	39	22	3	1	......	4	8	1	......	......	......	1	......	......	101	92	21
Rhode Island	16	4	4	2	1	1	1	3	4	2	1	1	......	2	......	......	2	......	......	......	......	......	8	6	2
Connecticut	21	3	5	4	......	......	3	5	15	1	......	......	......	2	......	......	......	......	......	......	......	......	15	12	4
New York	78	13	19	7	1	1	2	12	28	10	4	6	......	8	8	......	3	1	1	2	......	......	36	36	3
New Jersey	35	12	15	11	1	1	3	1	15	4	2	1	......	4	2	......	1	......	......	......	......	......	33	33	8
Pennsylvania	80	13	12	4	......	......	......	6	16	4	1	1	1	4	2	......	1	......	......	......	......	......	27	26	10
SOUTH ATLANTIC DIVISION.																									
Delaware	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Maryland	5	2	3	1	......	......	......	1	1	2	......	1	1	1	1	1	1	......	......	1	......	......	2	1	1
District of Columbia	1	......	1	......	......	......	1	......	1	......	......	......	......	......	......	......	......	......	......	1	......	......	......	......	......
Virginia	11	2	5	1	......	......	......	......	1	3	......	......	......	2	......	......	......	......	......	......	......	......	6	6	1
West Virginia	5	......	......	......	......	......	......	......	......	1	1	......	......	......	......	......	......	......	......	......	......	......	3	1	1
North Carolina	13	1	4	......	......	......	......	......	......	2	......	......	......	3	1	......	......	......	......	......	......	......	7	8	3
South Carolina	7	......	1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	3	2	......
Georgia	15	......	......	......	......	......	......	......	1	2	1	......	......	......	......	1	......	......	......	......	......	1	6	3	2
Florida	3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1	1	1

Statistical summary of cities making provision for exceptional children—Continued.

States.	Number of cities reporting.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners.		Vocational.	Continuation.	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible, refractory.	Dumb.	Home subnormal.	Provision for—		
								Day schools.	Night schools.														Medical inspection.	Physical examination for defects.	Dental clinics.
SOUTH CENTRAL DIVISION.																									
Kentucky	10	1	1	1				1	2	2	1			2									8	6	3
Tennessee	7	3	4	1				1															3	3	1
Alabama	10		1						1	1		1				1							2	2	1
Mississippi	10		2	1						2				2	2								3	2	
Louisiana	6		2				1		1	1	1												2	2	
Texas	31	3	5	3				2	3	6	3			2	1								19	9	1
Arkansas	8										1												7	4	
Oklahoma	8	3	3	1					1	1				1									4	3	
NORTH CENTRAL DIVISION.																									
Ohio	31	5	5	4	2	3	3	2	7	5	4	1	1	2	3		2		1				13	14	5
Indiana	45	5	10	5		2	1	1	7	6	3			5	6		1						28	18	8
Illinois	55	3	7	2	2	3	2	5	10	7	1	1		6		1			1	1			23	16	9
Michigan	43	8	12	7		10		1	8	8	1			3	2	1							23	19	6
Wisconsin	34	3	7	4	4	14	2	1	10	8				2	2								21	20	5
Minnesota	21	4	12	3	1	1	1	4	4	11	3	2	1	4	2	1		1					15	10	1
Iowa	28	1	1						2					1	1								15	11	1
Missouri	27	6	9	3		1		1	3	2		1		3	2		1						18	11	5
North Dakota	6	1	1	1						1				1									2	4	
South Dakota	2									1															1
Nebraska	7							1	1	1					1								5	3	
Kansas	23	2	2	1					1	5	2					1							11	4	3
WESTERN DIVISION.																									
Montana	6											1											1		1
Wyoming	1													1	1										
Colorado	10	3	5	2				3	3		1	1	1	3	3		1						6	9	
New Mexico	3	1	1	1				1			1												3		
Arizona	3		1					2		1				1									1	2	

Utah	2		1	1																			2	2	1
Nevada	1																						1	1	
Idaho	2		1						1	1				1	1								1	1	
Washington	6	1	1	2		1		1	2	1		2											5	2	3
Oregon	6	1	2	1		1		1	1	2		1			1								5	3	1
California	16	6	7	5	1	4	2	3	3	5		2		3	2					1	1		12	10	6

Cities making provision for exceptional children (indicated by ×).

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Alabama:																								
Birmingham		×						×	×													×	×	×
Mobile															×									
Tuskaloosa											×											×	×	
Arizona:																								
Bisbee							×															×	×	
Douglas							×																	
Prescott		×							×				×										×	
Arkansas:																								
Fayetteville																						×		
Fort Smith																						×	×	
Helena																						×		
Hot Springs																						×		
Little Rock										×												×	×	
Pine Bluff																						×	×	
Texarkana																						×	×	
California:																								
Bakersfield							×						×											
Berkeley																						×	×	×
Los Angeles	×				×		×				×								×	×		×	×	×
Oakland	×	×	×		×	×		×	×				×									×	×	×
Pasadena	×	×	×	×	×								×	×								×	×	
Pomona	×	×	×																			×	×	
Riverside																						×	×	
San Bernardino		×				×	×							×										
San Francisco	×	×	×		×			×	×		×											×	×	×
San Jose		×						×	×													×	×	×
Santa Ana	×	×	×																			×	×	×

Cities making provision for exceptional children (indicated by ×)—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
California—Continued.																								
Santa Barbara																						[1] ×		
Santa Clara																							×	
Santa Cruz									×													×		
Watsonville									×													×		
Colorado:																								
Boulder		×																				×	×	
Cripple Creek																							×	
Denver	×	×	×				×	×					×	×								×	×	
Leadville																×						×	×	
Pueblo		×						×						×								×	×	
Pueblo (district No. 1)	×	×	×				×	×		×	×	×	×	×									×	
Salida		×											×										×	
Trinidad	×						×															×	×	
Victor																						×	×	
Connecticut:																								
Ansonia								×														×	×	
Bridgeport	×	×	×					×					×									×	×	
Bristol								×														×	×	
Danbury								×																
Derby																						×	×	
Hartford		×				×	×															×	×	×
Manchester						×		×														×		
Meriden								×														×	×	×
Middletown								×														×		
New Britain		×	×				×	×	×				×									×	×	×
New Haven	×						×	×														×		
New London								×														×	×	
Rockville							×	×																
South Manchester		×	×			×	×	×														×	×	
Stamford								×																
Torrington																						×		
Wallingford								×															×	
Waterbury								×														×	×	×
Winsted	×	×	×																			×	×	
District of Columbia:																								
Washington		×				×		×											×					

Florida:																								
Ocala																						×	×	×
Georgia:																								
Athens																						×	×	
Atlanta								×														×	×	×
Augusta																						×	×	×
Columbus									×												×			
Cordele																						×		
Dublin										×														
Gainesville																						×		
Griffin															×									
Macon									×															
Thomasville																						×		
Idaho:																								
Pocatello		×											×	×									×	
Illinois:																								
Aurora					×																	×	×	×
Batavia							×															×		
Belvidere																						×		
Cairo									×															
Chicago	×	×	×	×	×	×	×	×	×	×	×		×		×			×	×			×	×	×
Danville	×	×																					×	×
Decatur		×																				×		×
De Kalb																						×		×
Dixon																						×	×	
Evanston																						×	×	
Galesburg																						×		
Harvey							•	×																
Hoopeston		×																				×		
Joliet	×	×						×																
Kewanee							×	×					×											
La Grange																						×		
La Salle		×						×					×											
Lincoln							×																	
Macomb																						×	×	×
Mattoon								×																
Maywood						×		×														×	×	
Moline									×													×	×	
Murphysboro													×									×		
Pana							×	×					×											
Pekin																							×	
Peoria																						×	×	×
Peru																						×	×	
Pontiac																						×		
Princeton									×															
Rockford								×														×	×	
Rock Island					×																			
Sterling								×														×	×	
Streator				×					×													×	×	
Sycamore									×															

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[1] Partially.

Cities making provision for exceptional children (indicated by ×)—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Illinois—Continued.																								
Urbana									×													×	×	×
Waukegan		×	×										×									×	×	×
Indiana:																								
Anderson								×														×		
Bloomington	×	×	×							×				×								×	×	
Columbus		×	×		×				×				×	×								×		
Connersville																×						×		
Crawfordsville									×													×		
East Chicago		×						×	×													×	×	
Evansville																						×		×
Fort Wayne																						×	×	×
Frankfort																						×		
Franklin																						×	×	×
Goshen								×																
Greenfield																						×	×	×
Hartford City										×												×		
Indianapolis	×	×	×					×						×								×	×	×
Kokomo	×	×							×													×	×	
La Fayette		×																				×	×	×
Laporte								×														×		
Lebanon																						×	×	×
Martinsville																						×		
Michigan City								×															×	
Mishawaka	×								×													×	×	
Muncie		×											×	×								×	×	
Noblesville		×	×						×				×	×								×	×	
Peru													×									×		
Plymouth																						×	×	
Richmond		×																				×		
South Bend		×	×		×		×	×		×			×									×	×	
Valparaiso														×								×	×	
Vincennes																						×	×	
Wabash	×					×																		
Washington																						×	×	×
Iowa:																								
Atlantic																						×		

Boone	×	×																				×		
Burlington																						×	×	
Cedar Rapids								×	×													×		
Chariton																						×		
Clinton																						×	×	
Davenport																							×	
Decorah																						×	×	
Des Moines								×														×	×	
Dubuque																						×	×	
Grinnell																						×	×	
Iowa City																							×	
Marion																						×		
Marshalltown																						×	×	
Newton													×	×								×		
Ottumwa																						×	×	
Sioux City								×																
Waterloo																						×	×	×
Kansas:																								
Atchison									×															
Chanute										×														
Emporia																						×		
Fort Scott																						×	×	
Horton																						×	×	×
Hutchinson																						×		
Junction City	×	×	×						×															
Kansas City								×							×									
Lawrence																						×		
Newton																						×	×	×
Ottawa																						×		
Parsons									×															
Pittsburg																						×	×	
Topeka	×	×							×	×														
Wellington																						×		
Wichita																						×		
Winfield									×													×		×
Kentucky:																								
Ashland																						×		
Covington		×							×				×									×	×	×
Danville									×													×		
Henderson																						×	×	×
Louisville	×		×				×	×		×												×	×	
Newport								×														×	×	×
Owensboro																						×	×	
Paris													×									×	×	
Louisiana:																								
Alexandria																						×	×	
Baton Rouge		×																						
New Orleans		×				×		×	×	×												×	×	
Maine:																								
Auburn								×														×	×	
Augusta								×														×	×	×
Bangor																						×	×	

Cities making provision for exceptional children (indicated by ×)—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Maine—Continued.																								
Bath																							×	
Brewer																						×	×	×
Brunswick		×						×															×	
Calais																							×	
Ellsworth																						×	×	
Houlton		×																						
Lewiston		×						×	×														×	
Oldtown																						×	×	×
Portland			×	×	×			×						×								×	×	
Saco																						×	×	
Westbrook																							×	
Maryland:																								
Annapolis																						×		
Baltimore	×	×	×				×	×	×		×	×	×	×	×	×			×			×	×	
Cumberland		×																						
Frostburg	×	×							×															
Massachusetts:																								
Abington														×								×	×	
Adams							×	×														×	×	
Amherst																						×	×	
Andover																						×	×	
Arlington		×	×						×					×								×	×	
Athol		×						×														×	×	
Attleboro																						×	×	
Barnstable																						×	×	×
Belmont	×	×	×											×								×	×	
Beverly					×			×	×													×	×	
Boston	×	×	×		×	×	×	×	×	×	×				×				×			×	×	×
Braintree																						×	×	
Brockton							×	×														×	×	
Cambridge						×		×	×													×	×	×
Canton																						×	×	×
Chelmsford							×															×	×	
Chelsea		×	×				×	×														×	×	
Chicopee									×													×	×	
Clinton								×	×													×	×	

Concord																					×	×	
Danvers																					×	×	
Dedham																					×	×	
Easthampton								×													×	×	×
Everett								×	×												×	×	
Fairhaven																					×		
Fitchburg		×							×				×								×		
Framingham								×													×	×	
Franklin																					×	×	
Gardner																					×		
Gloucester								×	×												×	×	
Great Barrington									×												×		
Hingham																					×	×	
Holyoke		×																			×	×	
Hudson																					×	×	×
Hyde Park		×																			×		
Ipswich								×													×		
Lee																					×	×	
Lexington																					×	×	×
Lowell		×					×	×													×	×	
Ludlow							×	×	×				×								×	×	
Lynn	×	×	×				×	×													×	×	×
Malden			×					×													×	×	
Mansfield		×																			×	×	
Marblehead		×	×										×								×	×	
Marlboro		×	×					×						×							×	×	×
Methuen																					×	×	
Melrose																					×	×	
Milford								×													×	×	
Millbury		×							×					×							×	×	
Milton									×												×	×	
Monson																					×	×	×
Natick								×													×	×	
Needham	×	×																			×	×	
New Bedford	×	×					×														×	×	×
Newburyport	×	×						×	×												×	×	
Newton		×	×					×	×												×	×	
North Adams																					×	×	×
Northampton								×													×	×	
North Andover																					×	×	
Northbridge								×													×	×	
North Brookfield									×												×	×	×
North Easton																					×	×	
Norwood		×																			×	×	×
Orange		×																			×	×	
Peabody								×													×	×	
Pittsfield		×						×													×	×	
Plymouth														×							×	×	×
Provincetown																					×	×	×
Quincy								×													×	×	
Randolph																					×	×	
Reading																					×	×	

Cities making provision for exceptional children (indicated by X*)*—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Massachusetts—Cont.																								
Revere																						X	X	X
Rockland								X														X		
Rockport								X														X	X	
Saugus		X							X													X	X	
Somerville		X	X					X	X	X												X	X	X
Southbridge	X	X						X														X	X	
South Hadley Falls								X														X	X	
Spencer																						X	X	
Springfield	X	X	X					X	X													X	X	
Stoneham																						X	X	
Stoughton																						X	X	
Swampscott																						X	X	
Taunton			X					X	X				X									X	X	
Turners Falls																						X		
Wakefield								X														X	X	
Waltham								X														X	X	X
Ware																						X	X	
Watertown	X	X						X														X	X	
Webster																						X	X	
Westboro																						X	X	
Westfield																						X	X	
West Springfield							X															X	X	
Weymouth																						X	X	
Whitman																						X	X	
Williamstown																						X		
Winchenden																						X	X	
Winchester									X													X	X	X
Winthrop		X												X								X	X	
Woburn								X	X													X	X	
Worcester		X	X				X	X		X				X								X	X	X
Michigan:																								
Adrian	X	X	X																			X	X	
Ann Arbor	X	X																				X	X	
Bay City					X																			
Benton Harbor																						X		
Bessemer																						X		

Big Rapids		×							×													×		
Cadillac		×							×														×	
Calumet					×																			
Charlotte													×											
Detroit	×		×		×		×		×													×	×	×
Escanaba	×	×	×																					
Grand Haven								×																
Grand Rapids	×	×	×					×		×														
Hancock																							×	
Hillsdale									×													×	×	
Houghton					×																			
Iron Mountain					×																	×	×	
Ironwood	×	×			×			×	×				×	×								×	×	
Jackson																						×	×	×
Kalamazoo		×	×		×			×														×	×	
Lansing																						×		
Ludington									×													×		
Manistique	×	×	×																			×	×	
Marine City																						×	×	
Marquette					×																		×	
Mount Clemens																						×		
Muskegon		×	×					×	×				×	×								×	×	×
Norway																								
Owasso																							×	
Pontiac																						×		
Saginaw, W. S		×			×			×														×	×	×
Sault Ste. Marie	×	×			×																	×	×	×
South Haven															×							×		
Three Rivers								×	×													×	×	×
Wyandotte								×																
Ypsilanti																						×	×	
Minnesota:																								
Albert Lea		×							×				×									×	×	
Anoka		×							×															
Austin		×							×				×										×	
Duluth	×	×					×															×	×	
Ely		×					×						×									×		
Eveleth								×	×													×	×	
Fairmont									×															
Faribault		×																						
Fergus Falls		×							×	×												×		
Hastings																						×		
Little Falls									×															
Mankato																						×		
Minneapolis	×	×	×					×			×			×	×							×	×	×
New Ulm																						×	×	
Owatonna		×							×													×	×	
Rochester	×	×	×	×	×	×	×	×	×	×	×	×	×									×	×	
St. Cloud																						×	×	
St. Paul	×	×	×				×	×	×	×				×								×	×	
Stillwater		×							×													×		
Winona																						×		

Cities making provision for exceptional children (*indicated by* X)—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Mississippi:																								
Greenville																						X	X	
Hattiesburg									X				X	X										
Jackson		X	X																					
Laurel																						X	X	
Water Valley		X							X				X	X								X		
Missouri:																								
Brookfield																						X		
Cape Girardeau		X											X									X		
Carterville																						X		
Carthage																X								X
Chillicothe																						X		
Columbia																						X	X	
De Soto		X																				X	X	
Fulton																						X	X	X
Hannibal	X	X												X								X		
Jefferson City																							X	
Joplin																						X	X	X
Kansas City	X	X	X					X			X											X	X	
Lexington	X	X											X											
Louisiana																						X	X	X
Macon		X																				X	X	
Marshall	X	X																						
Mexico																						X		
Poplar Bluff																						X	X	X
St. Joseph								X														X		
St. Louis	X	X	X		X		X	X	X													X	X	
Sedalia	X	X	X						X				X	X								X	X	
Trenton																						X		
Montana:																								
Bozeman																								
Butte											X													
Great Falls																						X		
Missoula																								X
Nebraska:																								
Grand Island																						X		
Hastings																						X		

Kearney									X													X	X	
Lincoln							X							X								X	X	
South Omaha								X																
York																						X	X	
Nevada:																								
Reno																						X	X	
New Hampshire:																								
Claremont																						X	X	
Concord								X	X													X		
Concord, Penacook District		X																				X	X	
Dover								X														X	X	
Laconia								X																
Manchester							X	X														X	X	
Portsmouth																						X	X	X
Rochester	X	X				X	X	X	X				X									X	X	X
New Jersey:																								
Asbury Park		X																				X	X	
Atlantic City		X	X					X														X	X	
Bayonne			X																					
Bloomfield	X	X	X					X		X												X	X	X
Bordentown																						X	X	
Bridgeton								X														X	X	
Camden	X	X	X					X														X	X	
Elizabeth	X	X							X													X	X	X
Englewood	X		X					X														X	X	X
Irvington		X	X																			X	X	X
Jersey City	X		X					X					X									X	X	
Kearney								X														X	X	
Montclair	X	X	X			X		X														X	X	
Newark	X	X	X	X	X	X		X	X	X	X											X	X	X
New Brunswick								X														X	X	
North Plainfield		X																				X	X	
Orange	X					X		X								X						X	X	
Passaic	X		X					X														X	X	
Paterson		X						X														X	X	
Perth Amboy	X																					X	X	
Plainfield	X	X												X								X	X	
Princeton																						X	X	
Rahway																						X	X	
Ridgewood		X											X									X	X	
Rutherford																						X	X	
South Amboy																						X	X	X
South Orange		X							X													X	X	
Summit		X																				X	X	X
Trenton	X	X	X				X	X	X				X	X								X	X	X
Union													X									X	X	
Vineland																						X	X	
West New York								X														X	X	
West Orange																						X	X	
Woodbury																						X	X	

Cities making provision for exceptional children (indicated by ×*)*—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
New Mexico:																								
Albuquerque	×	×	×				×			×												×		
Raton																						×		
Santa Fe																						×		
New York:																								
Albany	×	×					×	×	×															
Albion	×	×																						
Amsterdam	×	×						×					×	×										
Auburn			×								×								×					
Batavia								×	×															
Binghamton								×			×											×		
Buffalo	×	×	×			×	×	×	×		×											×	×	
Canandaigua																						×	×	
Catskill	×												×	×								×	×	
Cortland																						×	×	
Dansville																							×	
Dunkirk								×																
Elmira		×	×					×	×	×												×	×	×
Fishkill																							×	
Fulton	×							×														×		
Glens Falls		×											×	×										
Grandville																						×	×	
Herkimer								×																
Hoosick Falls																						×	×	
Hudson Falls																							×	
Ilion																							×	
Ithaca								×	×													×	×	
Jamestown	×	×						×															×	
Johnstown																×						×		
Kingston																						×		
Lackawanna								×					×									×		
Lancaster									×															
Lawrence	×	×														×							×	
Malone													×										×	
Mamaroneck																						×	×	
Mechanicsville																							×	
Mount Vernon		×					×	×	×													×	×	

Newark																					×	×	
Newburgh																							
New Rochelle	×	×	×					×						×							×	×	
New York	×	×	×	×	×	×	×	×	×	×	×		×	×			×	×			×	×	
Niagara Falls			×																				
North Tarrytown																						×	
Nyack		×																				×	
Ogdensburg	×	×								×											×	×	
Olean																							
Oneonta																					×	×	
Patchogue																					×		
Peekskill																						×	
Penn Yan		×												×					×				
Port Chester							×														×		
Port Jervis													×								×	×	
Poughkeepsie		×																			×	×	
Rensselaer																					×		
Rochester		×	×				×														×		
Rome																						×	
Rye							×														×		
Schenectady																					×	×	
Syracuse							×	×	×		×										×		
Troy	×	×					×	×													×		
Utica		×					×	×						×							×	×	
Waterford																					×	×	
Watertown								×			×										×	×	×
Whitehall							×						×								×	×	
White Plains		×						×								×					×	×	
Yonkers							×	×	×	×				×							×	×	×
North Carolina:																							
Asheville																					×	×	×
Durham	×	×							×														
Elizabeth City																						×	
Gastonia													×										
Goldsboro									×												×	×	
Kinston		×											×								×	×	
Newbern																					×	×	
Salisbury		×																			×	×	
Washington																							
Wilson		×											×	×							×	×	×
Winston Salem																					×	×	×
North Dakota:																							
Fargo	×	×	×										×								×	×	
Grand Forks																					×	×	
Jamestown																						×	
Valley City									×													×	
Ohio:																							
Akron								×								×					×	×	
Barberton									×													×	
Bellaire								×															
Bellefontaine																					×	×	

Cities making provision for exceptional children (indicated by ×)—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for— Medical inspection.		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Ohio—Continued.																								
Bellevue								×														×	×	
Bucyrus																							×	
Canton																×								
Cincinnati	×	×	×	×	×	×	×	×	×	×			×	×								×	×	×
Cleveland	×	×	×	×	×				×	×	×	×						×				×	×	×
Conneaut					×																			
Coshocton	×	×	×			×		×	×				×	×										
Delphos																						×		
East Liverpool																							×	
Elyria	×	×												×								×	×	
Galion																×								
Lima																						×	×	
Marietta																						×	×	
Sidney																						×		
Springfield																						×	×	
Toledo	×	×	×			×	×	×		×												×	×	×
Urbana																								×
Youngstown																						×	×	×
Oklahoma:																								
El Reno	×	×											×											
Guthrie																						×	×	
Lawton																						×	×	
Muskogee																						×		
Oklahoma City	×	×	×					×	×													×	×	
Ponca City	×	×																						
Oregon:																								
Astoria							×															×		
Eugene		×																				×		
Portland	×	×	×		×			×	×		×			×								×	×	×
Salem									×													×	×	
The Dalles																						×	×	
Pennsylvania:																								
Altoona								×																
Archbald	×						×	×																
Braddock																						×	×	×

Bristol																						X	X	
Butler	X	X												X										
Charleroi	X						X																	
Chester																						X	X	
Cory									X															
Danville																						X	X	
Darby																						X	X	
Donora								X															X	
Easton							X																	
Erie	X																					X	X	
Franklin	X	X																				X		
Harrisburg	X	X	X					X																
Jersey Shore		X																				X		
Kane									X															
Lancaster								X		X												X	X	
Mahanoy City																X								
Mauch Chunk	X	X	X										X										X	
Meadville																							X	
Milton																						X		X
Minersville																						X	X	
Mount Carmel								X																
Nanticoke								X																
New Brighton	X							X																X
New Castle								X																
Norristown																						X	X	X
North Braddock		X											X									X	X	X
Philadelphia	X	X						X	X													X	X	X
Phœnixville	X											X											X	
Pittsburgh							X	X														X	X	
Pottstown																								X
Punxsutawney																						X	X	
Rankin		X	X																				X	
Reading	X	X						X														X	X	X
Ridgeway																						X	X	
Sayre																						X		
Shamokin								X																
Shenandoah																						X	X	X
Slatington																						X		
Steelton	X	X																						
Sunbury													X											
Taylor							X	X																
Turtle Creek								X	X															
Tyrone																						X		
Uniontown													X										X	
Warren																						X	X	
West Chester																						X	X	X
West Pittston																						X		
Wilkes-Barre		X																				X	X	
Williamsport							X	X																
Wilmerding	X	X	X											X								X		
York											X												X	

Cities making provision for exceptional children (indicated by ×*)*—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Rhode Island:																								
Bristol	×	×							×				×			×								
Central Falls								×														×	×	
Cranston																							×	
East Providence																						×	×	
Johnston																						×		
Lincoln							×	×														×		
Newport																×						×	×	
Providence	×	×	×	×	×	×	×	×	×	×	×		×									×	×	×
Valley Falls																						×	×	×
Westerly	×	×	×																					
Woonsocket	×	×					×	×														×		
South Carolina:																								
Anderson		×																				×		
Columbia																						×	×	
Spartanburg																						×	×	×
South Dakota:																								
Sioux Falls									×															×
Tennessee:																								
Chattanooga	×																							
Dyersburg																						×		
Jackson		×																				×	×	
Knoxville	×	×																				×	×	×
Memphis		×	×				×																	
Nashville	×	×																					×	
Texas:																								
Brenham																						×	×	
Brownsville							×															×		
Brownwood																						×		
Cleburne																						×		
Corpus Christi																						×	×	
Dallas								×	×													×	×	
Denison	×	×	×																					
Denton	×	×	×						×	×			×									×	×	
El Paso							×															×	×	
Galveston		×																				×		
Houston			×					×														×	×	

Navasota									×	×												×	×	×
Orange		×							×					×								×	×	
Paris									×	×												×		
San Antonio	×	×						×														×		
Taylor																						×		
Terrell																						×	×	
Texarkana																						×		
Victoria									×													×		
Weatherford													×									×		
Utah:																								
Logan																						×	×	×
Salt Lake City		×	×																			×	×	
Vermont:																								
Barre								×														×		
Bellows Falls	×	×							×														×	
Bennington																							×	
Burlington								×															×	
Montpelier	×	×	×						×				×	×								×	×	
Rutland										×												×	×	
St. Albans																						×	×	
St. Johnsbury																							×	×
Virginia:																								
Alexandria	×	×																				×	×	
Bristol																							×	
Danville									×				×									×	×	×
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Norfolk	×	×	×						×				×									×	×	
Portsmouth		×																					×	
Radford		×																						
Richmond								×														×		
Staunton																						×	×	
Washington:																								
Olympia																						×		
Spokane	×	×	×				×	×			×											×	×	×
Tacoma			×		×			×			×											×	×	×
Vancouver									×													×		
Walla Walla																						×		×
West Virginia:																								
Huntington																						×		
Moundsville																						×		
Parkersburg									×	×												×	×	×
Wisconsin:																								
Antigo				×	×																		×	
Appleton					×																		×	
Ashland					×																			
Beaver Dam								×																
Beloit								×	×													×	×	
Berlin																						×		
Chippewa Falls	×	×																						
De Pere																								×
Eau Claire	×	×			×				×													×	×	
Grand Rapids									×													×	×	

Cities making provision for exceptional children (indicated by ×*)*—Continued.

Cities.	Delinquent.	Backward.	Defective.	Blind or semiblind.	Deaf or semideaf.	Open-air.	For foreigners, day schools.	For foreigners, night schools.	Vocational.	"Continuation."	Parental or residential.	Epileptic.	For late-entering children.	For gifted children.	Vacation schools.	Special-help teacher.	Stammerers, stutterers, lispers.	Crippled.	Incorrigible or refractory.	Dumb.	Home subnormal.	Provision for—		
																						Medical inspection.	Physical examination for defects.	Dental clinics.
Wisconsin—Continued.																								
Green Bay					×																	×	×	
Kenosha						×																×	×	
La Crosse					×								×	×								×	×	
Madison	×	×			×			×														×		×
Marinette					×																		×	
Marshfield									×													×		
Menasha																						×		
Menomonie									×														×	
Merrill																						×		
Milwaukee		×	×	×	×		×	×	×	×							×					×	×	×
Monroe		×																						
Oconto						×																	×	
Oshkosh					×			×														×	×	
Platteville			×	×					×															
Racine		×	×	×	×			×														×	×	
Rhinelander																						×	×	
Sheboygan			×		×			×														×	×	
Sturgeon Bay																						×	×	
Superior					×			×														×	×	×
Washburn								×														×	×	
Watertown								×	×													×		
Wausau		×			×								×	×								×	×	×
Wyoming:																								
Rock Springs													×	×										

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